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ABSTRACT

This annotated bibliography samples publications from 1978 to 1988. The term "integrated science teaching" is used in a broad sense, covering such topics as science, society and technology and a variety of matters of concern to any science educator. Levels include primary, secondary, higher, vocational and teacher education. This bibliography is limited to only those items dealing with integration across the whole curriculum such as primary education in a general sense, as well as environmental education. Excluded are teaching materials sold by commercial organizations that have their own means of dissemination. Only English language publication have been included. The bibliography contains more than 370 entries that are arranged chronologically by year of publication. Within each year the entries are arranged alphabetically by title. Each bibliographic entry contains an annotated description of the subject and a set of keywords that are used in the subject index. Each entry is identified by a sequential number, that is used in the indexes to refer back to the entry. The bibliographic entries are followed by indices of subjects, personal authors, meetings and corporate bodies, and titles and series. (KR)

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No. 18 The Social Relevance of Science and Technology Education. 1986 (English)

No. 19 The Teaching of Science and Technology in an Interdisciplinary Contex. 1986 (English)

No. 20 Mathematics for All. 1986 (English, French in press)

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No. 23 Use of Sea and its Organisms. 1987 (English)

No. 24 Innovations in Science and Mathematics Education in the Soviet Union. 1987 (English)

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No. 26 Sourcebook of Science Education Research in the Caribbean. 1988 (English)

No. 27 Pour un enseignement intégré de la science et de la technologie : trois modules. 1988 (français)

No. 28 Microbiological Techniques in School. 1988 (English)

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No. 31 Educational Materials Linking Technology Teaching with Science Education: Technology in Life. 1988 (English)

No. 32 Evaluation and Assessment in Mathematics Education. 1989 (English)

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No. 35 Mathematics, Education, and Society. 1989 (English)

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Science and Technology Education
Document Series No. 36

Bibliography in Integrated Science Teaching

by Judith Reay

Division of Science
Technical and Environmental
Education

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INTRODUCTION

This annotated bibliography samples publications from 1978 to 1988.

The term "integrated science teaching" is used in a broad sense here, covering such topics as science, society and technology and a variety of matters of concern to any science educator. Levels include primary, secondary, higher, vocational and teacher education. It has been necessary to limit this bibliography to only those items dealing with integration across the whole curriculum such as primary education in a general sense, as well as environmental education. Also excluded are teaching materials sold by commercial organizations: which have their own means of dissemination.

Otherwise, this is not a selective bibliography in the sense of being evaluative. In an attempt to meet the needs and resources of educators worldwide, the sample aims to represent as many local publications as possible, together with a selection of internationally-known items. Only English language publications have been perused.

The literature over the decade, published after the bibliography prepared by Benning et al in New Trends in Integrated Science Teaching, Vol V reveals an evolution in science education more or less in accordance with the trends identified by Haggis and Adey in 1978 in the same New Trends . There is now also more opportunity for educators to find a medium in which to publish their work and views, and it is those professionals which have made this bibliography possible.

The bibliography contains more than 370 entries which are arranged chronologically by year of publication. Within each year the entries are arranged alphabetically by title.

Each bibliographical entry contains an annotated description of the subject and a set of keywords which are used in the subject index. (Since practically all entries discuss integrated curricula in science education, these two keywords do not appear in the index). Each entry is identified by a sequential number, which is used in the indexes to refer back to the entry. The bibliographical entries section is followed by subject, personal author, meeting and corporate body, and title and series indexes.

It would not have been possible to find most of the works listed in this bibliography without the cooperation of the Bodleian Library and the libraries of the Oxford University Department of Educational Studies, Kings College London, the Kings College International Centre, Southampton University, The British Council, The British Educational Index of Leeds University and the Oryx Press as well as by many individual colleagues.

In preparing this work for publication, the author is indebted to the guidance and editing of the Science Education Section and the Computerized Documentation and Library Service of Unesco. The Software Development and Applications Division of Unesco was instrumental in the computerization of this information as a data base using the CDS/ISIS software, and in producing the final document in camera-ready form.

This bibliography is the first of a series to be compiled in the field of science and technology education using Unesco's computer facilities. Other bibliographies will follow using the same methodology.

BIBLIOGRAPHY IN INTEGRATED SCIENCE TEACHING

MAIN ENTRIES

1978

00001 - **The Activity approach in school science learning: foundations, theory and practice, with special reference to Science 5-13 Project and Nuffield 'O' Level Physics Programme.** Mwakyembe, Genesis R.A. London, Centre for Science Education, Chelsea College, University of London, 1978. 155 p. (eng). (Unpublished M.ED. (Science Education) dissertation). // University of London. Chelsea College

The concern of the author, a Tanzanian teacher trainer, is a science teaching and learning approach to meet the goals of Tanzania's Education for Self Reliance in the face of entrenched content-centred practice. Chapter V (90-114) includes a review of the methods of Science 5-13 and its strengths. Drawbacks identified include problems of communication between teacher and child, unreasonable expectations of teachers' work, and societal resistance.

Keywords: primary school curriculum; teaching methods; learning methods; activity learning; Tanzania UR - teacher student relationship; teacher role; pressure groups; physics education; upper secondary education.

// "Education for Self-reliance" (Tanzania UR) // Schools Council Science 5-13 Project (UK) // Nuffield O-level Physics Programme (UK)

00002 - **The Analysis of science curricula for Piagetian level of demand.** Shayer, Michael. Leeds, UK, Leeds University Centre for Studies in Science Education, 1978. p. 115-130. (Studies in science education; 5) (eng). // Leeds University (UK). Centre for Studies in Science Education

Describes a study based on the analysis of the Nuffield Combined Science curriculum together with the results of tests on a sample of first year pupils who had followed the course for a term. The conclusion is that, given an adequate exposure to a science course, pupils' performance is mostly determined by the level of thinking that pupils have attained. The author reflects on the origin of Nuffield Combined Science (for a selective school population) and considers the implications for comprehensive school pupils. He suggests an approach to arriving at a course suitable for a particular class.

Keywords: lower secondary education; educational psychology; child development; academic achievement; curriculum evaluation; UK - ability grouping; comprehensive schools.

// Nuffield Combined Science (UK)

00003 - **Consumer science and comparison shopping: a short interdisciplinary course.** Zipko, Stephen J. Washington, Heldref, 1978. p. 29-36. (Science activities; 15, 2) (eng).

A ten-day minicourse in consumerism is described which utilizes outside speakers, experiments, audiovisual material, and field trips to local stores. This is a junior high school course but is adaptable to elementary, secondary or college level.

Keywords: consumer education; learning modules; activity learning; short courses; USA - home economics education; lower secondary education.

00004 - **Curriculum and language: an investigation of a science curriculum in two cultural settings.** Isa, A.M. Norwich, UK, University of East Anglia, 1978. (1 v. in various pagings). (eng). (Unpublished Ph.D. thesis). // University of East Anglia (UK)

This study in the context of Scottish Integrated Science was carried out with Scottish and Malaysian children aged 13+. The former responded in English and the latter in Malay. Scientific terms had more everyday meaning for the Scottish children than for the Malaysian, and the learning materials were found to be related to the Scottish culture but not to the Malaysian.

Keywords: education and culture; language barriers; language of instruction; comparative education; UK; Malaysia - teaching materials; educational relevance.

// Scottish Integrated Science Project (UK)

00005 - **Curriculum development for astronomy and earth sciences in Japan.** Inamori, Jun. Tokyo, Japan Society of Science Education, 1978. p. 209-213. (Journal of science education in Japan; II, 4) (eng). // Japan Society of Science Education

Explains that Earth Sciences is a course of study for senior secondary schools in Japan, an integrated science course including astronomy, meteorology, geophysics, geochemistry and geology. Describes the history of the curriculum and summarises it.

Keywords: curriculum development; earth sciences; astronomy; physical sciences; upper secondary education; Japan.

00006 - **A Detailed teaching scheme for integrated science.** Hong Kong, HKASME, 1978. p. 46-96. (Journal of the Hong Kong Association for Science and Mathematics Education; VI, 2) (eng). // Hong Kong Association for Science and Mathematics Education. Integrated Science Sub-committee

Seeing the need to help teachers, the Association set up a working party. The outcome, presented here, is a sample set of detailed notes for the teacher (including options for less able and more able pupils). Even without the official scheme to which these notes relate, they are of interest as one attempt to provide aid to teachers who have the usual problems.

Keywords: curriculum guides; teaching guides; classroom techniques; Hong Kong - ability grouping.

00007 - **Elementary school science.** Karplus, Robert; Hall, William C.; Elstgeest, Jos; Morris, Robert W.; Dyasi, Hubert M.; Warren, Keith; Herandez, Dolores F.; Alabi, Rufus. Paris, Unesco, 1978. p. 47-109. (Prospects: quarterly review of education; VIII, 1) (eng; also in ara, fre, spa). // Unesco

This dossier consists of eight short papers giving inputs from USA, Asia and the Pacific and Africa. Reference is made to science programmes in these regions in the context of aims and strategies of science education, problems of mathematics and language of instruction, resources and teacher education.

Keywords: primary school curriculum; educational aims; teaching strategies - concepts; language of instruction; child development; mathematics education; teacher education; USA; Australia; Africa; Asia; Philippines; Nigeria.

00008 - **Geology, earth science and the core curriculum: geology and the Nuffield Combined Science course.** Fleming, D.A.; Sidley, M.J. Keele, UK, Association of Teachers of Geology, 1978. p. 35-37. (Geology teaching; III, 1) (eng). // Association of Teachers of Geology (UK)

Nuffield Combined Science has no geology, so the school has put some in. The modified scheme is outlined.

Keywords: earth sciences; geology education; lower secondary education; secondary school curriculum; UK.

// Nuffield Combined Science (UK)

00009 - **Geology, earth science and the core curriculum: geology in the Schools Council Integrated Science Project (SCISP).** Weaver, Rosemary. Keele, UK, Association of Teachers of Geology, 1978. p. 37-42. (Geology teaching; III, 1) (eng). // Association of Teachers of Geology (UK)

The author outlines practice in her school, together with some problems. Earth science integrates physics, chemistry and biological sciences as well. The pupils have been enthusiastic.

Keywords: earth sciences; geology education; upper secondary education; secondary school curriculum; student attitudes; UK.

// Schools Council Integrated Science Project (UK)

00010 - **History, science and technology.** Hennessey, R.A.S. London, HMSO, 1978. p. 20-25. (Trends in education; 1, Spring1978) (eng). // UK. Dept of Education and Science

The author, a history educator, argues that history has a clear and central role to play in developing a curriculum to prepare young people for life in a technology-based society. He develops working definitions of science, technology and history. In fact, he seems to advocate the injection of science and technology into history courses, but one should beware of pitfalls.

Keywords: science and technology; history education; general education; educational relevance.

00011 - **Integrated science.** (La Enseñanza integrada de las ciencias) Hall, William C. Paris, Unesco, 1978. p. 58-65. (Prospects: quarterly review of education; VIII, 1) (eng; also in fre, spa). // Unesco

The writer summarises changes in primary and elementary science in the previous decade and proposes a model (concepts-processes-content) which can be used to characterise all methods of teaching science. He illustrates with curricula in a variety of countries. Trends include change from content to process emphasis, discovery, increasing relevance, environmental science, use of objectives and learning theories, links to other subjects, and curriculum development. He stresses the need to improve the science background of teachers, especially if they are to teach integrated science, and encouraging them to produce their own courses.

Keywords: primary school curriculum; educational trends; teaching method innovations - primary school teachers; primary teacher education; educational aims; concepts; educational relevance; environmental education; learning processes; skill development; educational psychology.

00012 - **Integrated science at all levels.** Adey, Philip S. Tokyo, Japan Society of Science Education, 1978. p. 203-209. (Journal of science education in Japan; II, 4) (eng). // Japan Society of Science Education

Outlines the better-known integrated science curricula of the UK and shows that there is great variety. There is an attempt to convey what is meant by integrated science and a brief mention of some of its advantages.

Keywords: curriculum; UK.

00013 - **Integrated science education worldwide.** Chisman, Dennis. London, ICASE, 1978. 122 p. (eng). // International Council of Associations for Science Education // International Conference on Integrated Science Education Worldwide, Nijmegen, Netherlands, 1978

Includes summaries of the working group discussions (which formed the basis of the chapters in "New Trends in Integrated Science Teaching", v.5) as well as a list of papers submitted to the groups. Of special value is the full text of the plenary lectures.

Keywords: curriculum development - teacher education; primary school curriculum; secondary school curriculum; university curriculum; environmental education; health education; nutrition education.

00014 - **Integrated science for the less able.** Kellington, Steuart H.; Mitchell, Alison C. Harlow, UK, Longman Journals Divisons, 1978. p. 129-134. (Remedial education; XIII, 3) (eng).

The article was written shortly after the revision of Scottish Integrated Science to improve its suitability for pupils over the whole ability range, special attention being paid to the needs and problems of the less able. It outlines the procedure for the revision, and improved flexibility. It also outlines the various procedures for evaluating the revision, and the broad findings, which were encouraging.

Keywords: lower secondary education; low achievers; ability grouping - curriculum development; curriculum evaluation.

// Scottish Integrated Science Project (UK)

00015 - **Integrated science: reasons and constraints.** Fox, M.; Oliver, P.M. Hatfield, UK, ASE, 1978. p. 16-19. (Education in science; 79) (eng). // Association for Science Education (UK)

In their secondary school the authors modified "Science for the 70s" for Years 1 and 2, Nuffield Secondary Science for Year 3 and SCISP for Years 3 to 5. They met difficulties including laboratory facilities, money, technician assistance, and resistance from colleagues and administrators.

Keywords: secondary school curriculum; project implementation - teacher attitudes; school laboratories; educational administrators; UK.

// Scottish Integrated Science Project (UK) // Nuffield Secondary Science (UK) // Schools Council Integrated Science Project (UK)

00016 - **Latest development in Scottish Integrated Science.** Kellington, Steuart H.; Mitchell, Alison C. Hatfield, UK, ASE, 1978. p. 725-733. (School science review; 209) (eng). // Association for Science Education (UK)

The article begins with a brief history of the Scottish Integrated Science Project and then explains why a revision was needed. It gives the aims and objectives of the revised course, the design of the course materials, and describes the trials and evaluation. Practising teachers were heavily involved. Notes that the work is part of a process of continuous development.

Keywords: lower secondary education; curriculum development; UK - curriculum evaluation; ability grouping.

// Scottish Integrated Science Project (UK)

00017 - **Nuffield Combined Science: do the pupils understand it?** Shayer, Michael. Hatfield, UK, ASE, 1978. p. 210-223. (School science review; 211) (eng). // Association for Science Education (UK)

This curriculum supposed to be suitable for children in all-ability schools, is the most used of all Nuffield curricula. The author, well known for his techniques of analysing Piagetian development, shows that the structured development of concepts leaves most children behind before the end-points are reached (e.g. density as a weight to volume/ratio concept, pressure as a force per unit area concept). He points out that curriculum development has been carried out by people from the experience of the (able) children they had taught and their own development, but that today's school population is not achieving mastery of the minimal objectives.

Keywords: physics education; lower secondary education; curriculum development; secondary school curriculum; UK - learning processes; student evaluation; academic achievement.

// Nuffield Combined Science (UK)

00018 - **On the Nuffield philosophy of science.** Stevens, Paul. Oxford, UK, Carfax Publishing, 1978. p. 99-111. (Journal of the Philosophy of Education Society of Great Britain; XII) (eng). // Philosophy of Education Society of Great Britain

Explores the terms heuristic method, hypothesis, discovery, direct observation and the Nuffield Spirit. Generally, he criticises some of the theory underlying modern science courses and the way it works in practice. He sees an important incompatibility between learning and discovering. The errors can give rise to psychological mistakes. We need a different balance between discovery methods and more traditional demonstration methods.

Keywords: curriculum; science philosophy; concepts; teaching method innovations; heuristic method (teaching); educational trends; educational psychology; activity learning; practicums; demonstrations (educational).

// Nuffield Science Teaching Projects(UK)

00019 - **The Role of science education in a developing country.** King, Winston K. Accra, Ghana, GAST, 1978. p. 20-24. (Journal of the Ghana Association of Science Teachers; XVII, 2) (eng). // Ghana Association of Science Teachers

With particular reference to the Caribbean, the author attempts to clarify the meanings and functions of science and technology and argues that science education leads to a way of life that is essential for citizens in developing countries.

Keywords: educational goals; developing countries; civic education; Caribbean.

00020 - **School science for the education of all.** Davison, A. Hatfield, UK, ASE, 1978. p. 343-344. (School science review; LX, 211) (eng). // Association for Science Education (UK)

The author judges that there is total confusion in the curriculum planning of science, as an element in the whole curriculum of British schools. He sees the need for debate.

Keywords: core curriculum; curriculum development; UK.

00021 - **Schools Council modular courses in technology.** Page, R.L. Hatfield, UK, ASE, 1978. p. 342-343. (School science review; LX, 211) (eng). // Association for Science Education (UK)

The curriculum development strategy is flexible, involves practising teachers, further education lecturers and industrialists and embraces inservice teacher education. The *flexible approach should appeal to teachers.*

Keywords: technology; curriculum development; learning modules; modular instruction; UK - inservice teacher education; higher education; industry and education.

// UK. Schools Council // Modular Course in Technology (UK)

00022 - **Science for the least able pupils, leading to a CSE qualification.** Peck, M.J.; Williams, I.P. Hatfield, UK, ASE, 1978. p. 353-357. (School science review; XL, 211) (eng). // Association for Science Education (UK)

The difficulties faced by non-academic pupils and the needs of an assessment procedure for these children are identified. Features of the course (which draws on a range of British resources) are outlined.

Keywords: ability grouping; slow learners; comprehensive schools; examinations; core curriculum; upper secondary education; UK - activity learning; reading ability.

00023 - **Science in general studies: has it a place?** West, R.W. Macclesfield, UK, General Studies Association, 1978. p. 8-11. (General studies; 31) (eng). // General Studies Association (UK)

The writer is concerned about the weakness of the three A-level curriculum in the 6th and 7th years of secondary school. Therefore the question is how can general studies become sufficiently general to include an appreciation of science and technology as well as literature, the arts and social sciences. He suggests strategies for such a curriculum.

Keywords: sixth forms; general education; upper secondary education; secondary school curriculum; specialization - science and technology; humanities education; social studies; UK; curriculum development.

00024 - **Should science be included as part of general studies courses?** Lyth, M. Macclesfied, UK, General Studies Association, 1978. p. 17-19. (General education; 31) (eng). // General Studies Association (UK)

Gives aims of a science component of a course for non-science specialists in the sixth form. Ends by advocating the SCISP Patterns scheme, seeing it as a useful resource for sixth form general studies. He provides a short list of other reading.

Kevwords: sixth forms; general education; upper secondary education; UK.

// Schools Council Integrated Science Project (UK)

00025 - **The Social function of science education.** Williams, W.F. London, HMSO, 1978. p. 32-35. (Trends in education; 1978, 1) (eng). // UK. Dept of Education and Science

The author was one of the founders of the SISCON project for university science students. He explains the rationale of the project and outlines the materials produced.

Keywords: sociology of science; university curriculum; curriculum development; UK.

// Science in a Social Context (UK)

00026 - **Some implications of research conducted in mathematics education, psychology and socio-linguistics in Papua New Guinea.** Meek, C. Suva, Fiji Mathematics Association, 1978. p. 13-20. (eng). // Fiji Mathematics Association // Fiji Mathematics Association. Conference, Suva, 1978

This significant article stresses the influence of culture and language on Western-style problem-solving ability, and reminds us of the implications for currriculum development.

Keywords: education and culture; language barriers; mathematics education; problem solving; curriculum development; Papua New Guinea - sociolinguistics.

00027 - **The Sources of learning of young children.** Dyasi, Hubert M. Accra, Ghana, GAST, 1978. p. 9-14. (Journal of the Ghana Association of Science Teachers; XVII, 2) (eng). // Ghana Association of Science Teachers

The Program Director for the Science Education Program for Africa (SEPA) outlines three distinct sources of learning which enter into almost every SEPA lesson: tradition, experience and reflective abstraction. An important article from an insightful, original and experienced educator.

Keywords: education and culture; learning processes; primary school curriculum; cultural identity; Africa - reasoning.

// Science Education Programme for Africa

00028 - **Unified science and teacher's conceptual level.** Heikkinen, Michael V.; Armstrong, Terry. Bowling Green, Ohio, School Science and Mathematics Association, 1978. p. 513-516. (School science and mathematics; LXXVIII, 6) (eng). // School Science and Mathematics Association (USA)

Teachers are seen as having attained differing conceptual levels, this influencing the extent to which they can use data from multiple sources and the level at which they can use knowledge. Thus the teacher's approach to teaching the subject is affected, and only at the higher conceptual levels will teachers be able to unify their teaching.

Keywords: teacher effectiveness; educational psychology; teaching methods.

00029 - **Ways of assessing how effectively a curricular innovation has been implemented.** Brown, Sally. Penang, Malaysia, SEAMEO-RECSAM, 1978. p. 25-37. (Journal of science and mathematics education in Southeast Asia; 1, 1) (eng). // SEAMEO. Regional Centre for Education in Science and Mathematics

Discusses some of the ways in which interviews, questionnaires and classroom observation may be used to explore the extent to which curricular innovations are being implemented in schools. The focus is on exploring the problems of implementation of the Scottish Integrated Science Scheme used in Scotland.

Keywords: curriculum evaluation; educational innovations; teacher effectiveness; UK - interviews; questionnaires.

// Scottish Integrated Science Project (UK)

1979

00030 - **"Acceptability Equations" and case studies of three major disasters involving industrial chemicals.** Burton, W.H. Hatfield, UK, ASE, 1979. p. 624-634. (School science review; LX, 213) (eng). // Association for Science Education (UK)

A description of an approach used in a sixth form General Studies Science and Society course. The case studies are frightening.

Keywords: upper secondary education; general education; social problems; man-made disasters; UK - teaching strategies.

// "Science in Society" (UK)

00031 - **Alternative technology=non conventional renewable.** Richmond, Peter E. London, Institute of Physics, 1979. p. 1. (Physics education; xiv, 1) (eng). // Institute of Physics (UK)

Well known for his interest in solar energy investigations in schools, the author suggests that the time may now have come for school physics to go 'applied'. Alternative technology uses basic physics, and energy is a theme for integrated science if ever there was one. No community in the world, he argues, can afford to neglect the study of the capture of energy from renewable sources.

Keywords: physics education; energy education; renewable energy sources; solar energy.

00032 - **Alternatives for science education: a consultative document.** Hatfield, UK, ASE, 1979. 61 p. (eng). // Association for Science Education (UK)

The document aimed to stimulate discussion which would lead to a forward looking science education policy of the Association through the 80s. Part 1 is a historical review attempting to identify elements in the development of British education which account for the state of education in the 70s. Part 2 broadly surveys the present. Part 3 presents options for the future, each covering three phases: (1) 5-11 years (2) 11-16 years (3) 16-18 years. Three models are presented in order of increasing innovativeness.

Keywords: primary school curriculum; secondary school curriculum; upper secondary education; educational trends; UK - educational history; educational innovations; curriculum development.

ISBN: 0-902-786-49-0.

00033 - **The Assessment of project work in science.** Lancaster, Colin M. Cave Hill, Barbados, School of Education, Uniersity of the West Indies, 1979. p. 19-26. (Caribbean journal of science education; II,01) (eng). // University of the West Indies (Barbados). School of Education

Reviews the nature and aims of project work in science and suggests an instrument for *assessment of secondary school integrated science projects.*

Keywords: student projects; evaluation methods; secondary school curriculum; Caribbean.

00034 - **Bibliography on integrated science education.** Benning, Barbara; Lockard, David; Showalter, Victor; Thomson, Barbara. Paris, Unesco, 1979. p. 175-226. (New trends in integrated science teaching; 5) (eng; also in fre, spa). // Unesco // International Conference on Integrated Science Education Worldwide , Nijmegen, Netherlands, 1978

An annotated bibliography of 457 items covering work published since volume III (1974) of this New Trends series, which also contains a bibliography on integrated science education.

Keywords: bibliographies.

00035 - **Bibliography on integrated science education.** Benning, Barbara; Lockard, David; Showalter, Victor; Thomson, Barbara. Paris, Unesco, 1979. p. 175-226. (New trends in integrated science teaching; 5) (eng; also in fre, spa). // International Conference on Integrated Science Education Worldwide, Nijmegen, Netherlands, 1978

An annotated bibliography of 457 items covering work published since Volume III (1974) of this New Trends series, which also contained a bibliography on integrated science education.

Keywords: bibliographies.

00036 - **Chemistry for artists and art buffs.** Denio, Allen A. New York, American Chemical Society, 1979. p. 30-33. (Journal of chemical education; 66, 1) (eng). // American Chemical Society

This course provides an attractive introduction to chemistry for a group of students who would normally avoid traditional chemical courses. Topics include color, pigments, metals, ceramics, glass, paints, plastics, fibers, and dyes.

Keywords: art education; chemistry education; interdisciplinary approach - curriculum guides; higher education.

00037 - **Children's abilities in using seven of Piaget's logical operations in problem solving.** Sintoovongse, K.; Wattanaseree, U.; Tantriratana, K. Penang, Malaysia, SEAMEO-RECSAM, 1979. p. 5-15. (Journal of science and mathematics education in Southeast Asia; II, 0202) (eng). // SEAMEO. Regional Centre for Education in Science and Mathematics

A report on research with Thai children. The results showed that older children were able to outperform younger children in some of the operations but not in others; and that the new Thai science textbook had no influence on the performance of the older children. Implications for the teaching of science are discussed.

Keywords: mental development; problem solving; academic achievement; teaching strategies; Thailand - age differences; textbooks.

00038 - **Cognitive development in some Caribbean secondary schools.** Adey, Philip S. Kingston, Jamaica, University of the West Indies, 1979. p. 197-220. (Caribbean journal of education; VI, 3) (eng). // University of the West Indies (Jamaica). School of Education

A report of a study of some 2300 children aged 11 to 15 in the four largest Caribbean countries in four kinds of secondary school. Cognitive levels, rates of development, and sex differences have important implications for curriculum and teaching method.

Keywords: secondary school students; secondary school curriculum; Caribbean - teaching methods; sex role; cognition; child development.

00039 - **Co-operation between cousins: science and mathematics educators look at what is possible and what has proved not possible.** Fensham, PeterJ. London, Taylor and Francis, 1979. p. 347-352. (European journal of science education; I, 3) (eng).

This is a somewhat critical review of the outcomes of an ICSU/Unesco meeting. The author seems to feel that participants took a rather simplistic view of the issues, problems and challenges, and the article could lead to debate between science and mathematics teacher educators. The title of the article is not particularly informative.

Keywords: mathematics education; teacher education; teacher attitudes; educational coordination.

// International Council of Scientific Unions // Unesco // Meeting on cooperation between science teachers and mathematics teachers, Bielefeld, Germany FR, 1978

00040 - **CXC and science: some issues about Basic and General Proficiency.** Brathwaite, Workeley E. Cave Hill, Barbados, University of the West Indies, 1979. p. 26.28. (Caribbean journal of science education; I, 1) (eng).

Examing the Caribbean Examinations Council Fact Sheet just before the first CXC examinations, the writer discusses the definitions of Basic and General Proficiency levels and their implications for science programmes. He shows that there are a number of issues which have not received attention.

Keywords: upper secondary education; Caribbean.

// Caribbean Examinations Council

00041 - **Do they teach physics abroad?** Vries, P.J. de. London, IoP, 1979. 65 p. (Physics education; XIV, 2) (eng). // Institute of Physics (UK)

A Dutch educator compares the number of physics periods in various countries, and concludes that in Britain there is time to link science in society compulsorily to physics, chemistry or biology if one of these is studied to A level. In Holland in 1980 about 10% of the examinations were linked to science in society for the schools that ask for it.

Keywords: upper secondary education; physics education; comparative education; Netherlands; UK - biology education; chemistry education; examinations.

00042 - **Do you really care?** Sandercock, Ted. Parkside, South Australian Science Teachers Association, 1979. p. 41-43. (South Australian Science Teachers Association journal; 792) (eng). // South Australian Science Teachers Association

Discusses the development of programs for Australian secondary school students of year 11 and 12. A modular science syllabus which has been developed in New Zealand and some examples of how some Australian schools have devised unified science programs are also discussed.

Keywords: learning modules; modular instruction; interdisciplinary approach; physical sciences; upper secondary education; Australia - curriculum development; New Zealand.

// New Zealand Modular Science

00043 - **Educational research and science teaching.** Whitfield, Richard C. Hatfield, UK, ASE, 1979. p. 411-430. (School science review; LX, 212) (eng). // Association for Science Education (UK)

The author observes that science educators have been as slow as any other kind of educators to base the process of teaching on research, but that the climate is changing considerably. Science teachers are increasingly coming to see the need to take research findings into account when executing their work. The article describes and comments on some results in science education.

Keywords: educational research; teacher attitudes; curriculum development; teaching methods; UK.

00044 - **Environmental approach: primary science curriculum, Belize.** Raymond, Ernest. London, International Council of Associations for Science Education, 1979. p. 40-45. (Science education for progress: a Caribbean perspective) (eng). // International Associations for Science Education

Outlines REAP, the Rural Education and Agriculture Project of Belize, which integrates rural environmental knowledge, skills and attitudes into a curriculum the aim of which is education relevant to the Belizean child.

Keywords: rural education; environmental education; agricultural education; educational relevance; rural environment; primary school curriculum; Belize.

// Rural Education and Agriculture Project (Belize)

00045 - **Facts or principles: directions in science education.** Malcolm, G.N. Wellington, New Zealand Science Teachers Association, 1979. p. 27-30, 35-38. (N Z science teacher; 21) (eng). // New Zealand Science Teachers Association

Briefly reviewing the ideologies of the waves of post-Sputnik curriculum developers, and views on the nature of science, a professor of physical chemistry concludes that *school courses should contain both facts and principles. He challenges many of the beliefs of science educators of the day, and suggests that curriculum development has ended up not very far from its starting point.*

Keywords: curriculum development; science philosophy; educational aims; educational trends.

00046 - **A Further look at some old myths.** Woolnough, Brian E. Hatfield, UK, ASE, 1979. p. 21-24. (Education in science; 81) (eng). // Association for Science Education (UK)

Some very interesting trends in O level, A level, CSE and university entries are given.

Keywords: educational trends; examinations; educational certificates; upper secondary education; UK.

// General Certificate of Education (UK) // Certificate of Secondary Education (UK)

00047 - **Home economics today and tomorrow.** Chambers, Judy. Dunedin, New Zealand, Association of Home Science Alumnae, 1979. p. 72-80. (Journal of the Association of Home Science Alumnae New Zealand; LXVIII) (eng). // Association of Home Science Alumnae (New Zealand)

This article will be of interest to those concerned about general issues of curriculum, and the relationship between science education and home economics education.

Keywords: home economics education; interdisciplinary approach; educational trends.

00048 - **The implementation of curricula adapted from Scottish Integrated Science.** Williams, Iolo Wyn. Jerusalem, Israel Science Teaching Centre, Hebrew University, 1979. p. 295-299. (Curriculum implementation and its relationship to curriculum development in science) (eng). // Hebrew University (Israel). Science Teaching Centre // Seminar on Curriculum Implementation and its Relationship to Curriculum Development in Science, Jerusalem, 1978

Scottish Integrated Science formed the foundation of lower secondary science curricula in a number of different countries of the Commonwealth in the late 1960s and early 1970s. The advantages and disadvantages are identified.

Keywords: curriculum development; lower secondary education; educational cooperation; comparative education - UK; Trinidad and Tobago; Malaysia; Lesotho; Botswana; Swaziland; Hong Kong; Brunei; Israel.

// Scottish Integrated Science Project (UK) // West Indies Science Curriculum (Trinidad and Tobago) // Malaysian Integrated Science // Boleswa Integrated Science (Africa) // Hong Kong Integrated Science // Brunei Integrated Science

00049 - **The implementation of curriculum change in school science in England and Wales.** Waring, M. London, Taylor and Francis, 1979. p. 257-275. (European journal of science education; I, 3) (eng; abstr. in fre, ger).

The limited evidence available suggests that, in the dissemination and diffusion of curricula, the project teams were not too successful in developing teachers' perceptions of the projects' messages. Accordingly, and also because more attention was paid to the materials than to the teachers, implementation has been less than expected. The writer concludes that innovation needs to arise from teachers working together (with some outside help) on classroom-based action research, reflecting on their own practice and building a body of theory rooted in the real world of the classroom.

Keywords: educational innovations; curriculum development; teacher effectiveness; inservice teacher education; UK - educational aims; teaching materials; curriculum research; teacher attitudes; classroom environment.

00050 - **Innovations in science and technology education, v.I.** (innovaciones en la educacionen ciencias y tecnologia, Vol I) Layton, David. Paris, Unesco, 1986. 188 p. (Innovations in science and technology education; 1) (eng; also in ara, fre, spa). // Unesco

Chapters from a variety of contributors cover teaching of the various scientific disciplines. Integrated and interdisciplinary science teaching, education in technology, nutrition and health, social relevance, teaching in relationship to the local environment and links with industry and agriculture are included. The book is addressed to science educators, ministry of education officials and practising teachers.

Keywords: teaching method innovations - primary education; secondary education; community development; biology education; biotechnology; chemistry education; teaching methods; physics education; mathematics education; computer assisted instruction; computer applications; calculating machines; educational cooperation; curriculum development.
ISBN: 92-3-102374-8(eng); 92-3-202374-1(fre); 92-3-302374-5(spa); 92-3-602374-6(ara).

00051 - **Integrated science education in primary schools in Rome: the research project of the university-school group.** Arca, M.; Vicentini-Missoni, M. London, Taylor and Francis, 1979. p. 125-129. (European journal of science education; I, 1) (eng).

Outlines the project of the University of Rome and its philosophy. Mentions the desired nature of educational research.

Keywords: primary school curriculum; Italy - teachers; curriculum development; educational research.

00052 - **Integrated science to O-level: a case study.** Lambert, Ernos N. London, ICASE, 1979. p. 46-51. (Science education for progress: a Caribbean perspective) (eng). // International Council of Associations for Science Education // Conference on Science Education for Progress: a Regional Perspective, Bridgetown, 1979

As the first Caribbean Examinations Council examination in the core subject integrated science is imminent, the leader of the Syllabus Panel (a school teacher) discusses measures necessary to facilitate its implementation. These include enhanced 'marketing', increased flow of information to science teachers, the exploitation of a full range of strategies for teacher reorientation and for revision of the syllabus, clarification of the practical and project work elements, and the production of guides.

Keywords. examinations; core curriculum; upper secondary education; Caribbean - curriculum development; inservice teacher education; refresher courses; practicums; student projects; teaching guides.
// Caribbean Examinations Council

00053 - **The introduction of integrated science teaching in Swaziland, 1972-1976.** Slimming, David. Accra, Ghana, GAST, 1979. p. 39-45. (Journal of the Ghana Association of Science Teachers; XIX, 1) (eng). // Ghana Association of Science Teachers

Describes the rationale and background of the Swaziland Integrated Science Project and its initial impetus from the Swaziland Science Teachers' Association. From five existing projects West Indies Science Curriculum Innovation Project was selected as the most suitable for adaptation to the Swaziland Integrated Science Project. Describes the development and trial procedures, which were concurrent and which were typical of that era. Includes a description of how the teachers were prepared and how examiners were controlled.

Keywords: curriculum development; lower secondary education; Swaziland; Caribbean.
// Swaziland Science Teachers Association // Swaziland Integrated Science Project

00054 - **Investigating the human environment: land use.** Hickman, F.M. Boulder, Colo., BSCS, 1979. p. 7-16. (Biological Sciences Curriculum Study journal; II, 1) (eng). // Biological Sciences Curriculum Study (USA)

An outline, with examples, of a curriculum emphasising problem-solving and decision-making. It is intended to be used in a variety of classes from social studies to advanced science.

Keywords: interdisciplinary approach; secondary education; problem solving; decision making; USA - land use; environmental education; social studies.

00055 - **Lifelong education: a new challenge.** Gestrelius, K. London, Taylor and Francis, 1979. p. 277-292. (European journal of science education; I, 3) (eng; abstr. in fre, ger).

The concept of lifelong education, recurrent education and lifelong learning are first explored. Necessary conditions for lifelong learning are outlined. A Unesco study developed a set of criteria for determining factors favourable to lifelong learning, the criteria being listed here. The author describes how these were applied in Sweden, and gives the results of the analysis. Deficiencies are identified. Science educators elsewhere could find this article of interest in judging whether what goes on in schools and in science teaching is conductive to lifelong development.

Keywords: lifelong education; recurrent education; learning processes; adult education; adult learning; Sweden.
// Unesco

00056 - **Mathematics modeling: a new approach to teaching applied mathematics.** Burghes, D.N.; Borrie, M.S. London, Institute of Physics, 1979. p. 82-86. (Physics education; XIV, 2) (eng). // Institute of Physics (UK)

Believing that applied mathematics is too idealised to interact with reality, the authors suggest a new approach, which they call applicable mathematics. The possible relationship with physics, chemistry, technology, economics, management, geography, demography, biology/medicine and sport are illustrated.

Keywords: mathematics education; interdisciplinary approach; teaching strategies.

00057 - **A Model of test development procedure for Nigerian Integrated Science: the construction and evaluation of a test to measure a unit on motion.** Oyebanji, P.K.; Lockard, David. Ibadan, Nigeria, STAN, 1979. p. 64-67. (Journal of the Science Teachers Association of Nigeria; XVIII, 1) (eng). // Science Teachers' Association of Nigeria

The development procedure, and evaluation of the test, are described. The test is not given.

Keywords: educational testing; curriculum evaluation; Nigeria.
// Nigerian Integrated Science Project

00058 - **The Modern trends of science education in primary schools.** Yeoh Oon Chye. Singapore, Science Teachers' Association of Singapore, 1979. p. 30-40. (Scientas; XIII, 2) (eng). // Science Teachers' Association of Singapore

Believes that school science education should leave students interested in science and prepared to cope with the future. Identifies five pedagogical elements of science education: pupil, teacher, objectives, content and the environment for science teaching and learning, and discusses these briefly. Diagrammatically summarizes the interpretations of inquiry by various authorities. Finally asks nine questions intended to help a teacher analyse whether her curriculum is in keeping with trends.

Keywords: primary school curriculum; educational aims; motivation - student attitudes; teacher attitudes; classroom environment; teacher effectiveness; activity learning; Singapore.

00059 - **Modular courses in technology at O Level and CSE.** Page, R.L. London, IoP, 1979. p. 255-261. (Physics education; XIV, 4) (eng). // Institute of Physics (UK)

A flexible approach to courses which can be taught by either science or craft teachers or both.

Keywords: technology; learning modules; modular instruction; upper secondary education; examinations; UK.
// Modular course in Technology (UK)

00060 - **The Need for a biosociology.** Wallace, B. Boulder, Colo., BSCS, 1979. p. 1-3. (Biological Sciences Curriculum Study journal; II, 1) (eng). // Biological Sciences Curriculum Study (USA)

Author of a book on social biology, and designer of a course called Biology and Society for non-majors at Cornell University, the author believes that the time has come for a new discipline, biosociology. Welding together sociologists and biologists, such a discipline should be introduced at once into the university curriculum. Goals, organisation and content are suggested.

Keywords: biology education; sociology; interdisciplinary approach; university curriculum; USA - life sciences.

00061 - **New trends in integrated science teaching, v.5.** (Nuevas tendencias en la ensenanza integrada de las ciencias V) Reay, Judith. Paris, Unesco, 1979. 238 p. (New trends in integrated science teaching) (eng; also in fre, spa). // Unesco // International Conference on Integrated Science Education Worldwide, Nijmegen, Netherlands, 1978

The book is the outcome of a conference which aimed to take stock of the development over the previous decade and to look forward to the 80s and beyond. A number of chapters are summaries of the plenary addresses. The rest reflect working group discussions and the *experience of a variety of specialists. Appendices include a 457-item bibliography on integrated science education, guidelines on the introduction of integrated science, and information about the authors of these and other papers presented for discussion.*

Keywords: educational trends - curriculum development; curriculum evaluation; educational levels; teacher education; educational relevance; teaching materials; teaching methods; general education; bibliographies.

ISBN: 92-3-101757-8.

00062 - **1979: progress and promise.** Mayer, W.V. Boulder, Colo., BSCS, 1979. p. 1-2. (Biological Sciences Curriculum Study journal; II, 3) (eng). // Biological Sciences Curriculum Study (USA)

BSCS claims to be transdisciplinary in concept but is frankly hard-sell. Those interested in issues of the social and human context of biology teaching, and in values and ethics, could find a critical examination of the article useful.

Keywords: biology education; life sciences; interdisciplinary approach; USA - social values; ethics of science; humanism.

00063 - **Piggy-in-the-Middle: a plea for cooperation between mathematics and science teachers in secondary schools.** Turner, Anthony D. Hatfield, UK, ASE, 1979. p. 773-778. (School science review; LX, 213) (eng). // Association for Science Education (UK)

There is a mismatch between the approach of teachers of science and mathematics. The article suggests some reasons for this, and some changes in approach which might help to solve the problem.

Keywords: mathematics education; teacher attitudes; teaching strategies.

00064 - **Presidential address: what next?** Booth, Norman. Hatfield, UK, ASE, 1979. p. 153-156. (School science review; LXI, 214) (eng). // Association for Science Education (UK)

From his long experience the ASE president urges teachers to remember how and why they are teaching science in an age of accelerated science and technology. He suggests that training courses may be turning teachers into slaves of educational technology, and asks teachers to loosen their bonds and become liberated. Teachers will recognize the wisdom and experience in this article.

Keywords: teacher attitudes; educational aims; technological change - teacher education; educational technology; teacher responsibility; teaching strategies.

00065 - **Problems in the organisation and implementation of a model integrated science course in Nigerian schools.** Oriaifo, S.O. Ibadan, Nigeria, STAN, 1979. p. 89-93. (Journal of the Science Teachers' Association of Nigeria; XVII, 3) (eng). // Science Teachers' Association of Nigeria

This was a background paper for a workshop to revise STAN's Nigerian Integrated Science Project. As such, it attempts to identify issues about the teacher, laboratory space and facilities, and the learner and his background. The paper also reports on an opinion poll taken of teachers and students, and makes recommendations for the workshop.

Keywords: curriculum development; curriculum evaluation; lower secondary education; Nigeria - teacher attitudes; student attitudes; school laboratories.

// Nigerian Integrated Science Project

00066 - **Pupils' attitudes to the social implications of science.** Ormerod, M.B. London, Taylor and Francis, 1979. p. 177-189. (European journal of science education; I, 2) (eng).

A follow-up on the author's earlier "attitudes to science" work through extension of the SOCATT (social implications) sub-scale. Links reported for SOCATT/Science Subject Preference, while weak, are of interest; so, too, are those with Teacher Liking. Useful background reading for science educators at all levels, especially teachers, teacher trainers and curriculum developers.

Keywords: student attitudes; social values; UK - teacher student relationship.

00067 - **Recommendations on the revision of junior secondary science based on observation in the classroom.** Wilson, James D. Victoria, B.C., BC Science Teachers Association, 1979. p. 24-26. (The BC science teacher; XXI, 2) (eng). // British Columbia

Science Teachers' Association (Canada)

A practising teacher's views and suggestions related to scope and sequence in a ministry course. Worth reading by those evaluating similar programs.

Keywords: lower secondary education; classroom environment; curriculum development; curriculum evaluation; Canada.

00068 - **The Relevance of new science and related education in Bangladesh: some salient features.** Ullah, A.K.M. Obaid. Bombay, British High Commission, British Council Division, 1979. p. 5-9. (Bombay science and education newsletter; 70) (eng). // British Council

Identifies aspects of new draft national curricula. The emphasis on technology is outlined and justified as an aid to national development. In an attempt to end the isolation of educated people from the masses, human and social qualities are to be developed, and the new curriculum integrates the humanities and social sciences with science and technology. Vocational education has been introduced side by side with general education after primary level. An emphasis on work-oriented education as an integral part of general education is intended to ensure the all-round development of personality. Among the compulsory subjects is one which relates education to life and the environment, a combination of social sciences and physical and biological sciences. Finally, the curriculum is intended to stimulate originality and creativity (although the primary aim of education is to produce efficient and skilled manpower).

Keywords: general education; educational relevance; education and development; interdisciplinary approach; educational goals; Bangladesh - technical and vocational education; manpower needs; physical sciences; life sciences; social studies.

00069 - **A Review of integrated science education worldwide.** Haggis, Sheila M.; Adey, PhilipS. Leeds, UK, Leeds University Centre for Studies in Science Education, 1979. p. 69-89. (Studies in science education; 6) (eng). // Leeds University (UK). Centre for Studies in Science Education

Aims to provide an overall picture of the state of integrated science education today, and to identify worldwide trends in the development of teaching and learning in integrated science.

Keywords: curriculum; curriculum development; educational trends; comparative education.

00070 - **Rural Education and Agricultural Project in Belize.** Raymond, Ernest. Cave Hill, Barbados, University of the West Indies, 1979. p. 29-30. (Caribbean journal of science education; I, 1) (eng). // University of the West Indies (Barbados)

REAP is designed for children remaining in primary school after the age of 11 years. Observing that REAP has much to offer in terms of educational and economic development, the writer outlines the education and development strategies used in the first phase of the project. Educators will recognise the significance of these strategies, and the article should be consulted by those interested in relevant development in education.

Keywords: rural education; agricultural education; lower secondary education; Belize - educational strategies; educational relevance.

// Rural Education and Agriculture Project (Belize)

00071 - **Science and society.** King, Winston K. Cave Hill, Barbados, School of Education, University of the West Indies, 1979. p. 4-7. (Caribbean journal of science education; I, 0101) (eng). // University of the West Indies (Barbados). School of Education

Society is seen as an essential concern in school science courses. A set of eleven topics are suggested, to ensure that Caribbean youth is trained, not only as scientists, but as responsible citizens.

Keywords: social responsibility; civic education; Caribbean - education and employment; educational relevance.

00072 - **Science curriculum and cognitive levels in the Caribbean.** Adey, Philip S. London, Chelsea College, University of London, 1979. 257 p. (eng). (PhD dissertation). // University of London. Chelsea College

The study contains an analysis of WISC in terms of cognitive demands and sets this *against cognitive levels found in Caribbean children on the basis of Piagetian measures. In general, a mismatch was found, and there is discussion of the implications for science curriculum development.*

Keywords: academic standards; academic achievement; curriculum development; curriculum evaluation; secondary school students; Caribbean - educational psychology.

// Piaget, Jean // West Indies Science Curriculum (Trinidad and Tobago)

00073 - **Science curriculum directions: purpose planning and perspective.** Ramsey, Gregor. Wellington, New Zealand Science Teachers Association, 1979. p. 40-45. (N Z science teacher; 21) (eng). // New Zealand Science Teachers Association

Aims in science teaching in the decades from the 1950s to the 1980s are compared. The interaction between science teaching and society is considered, and the writer predicts that teachers will face ever-increasing challenges in the future.

Keywords: educational trends; educational aims; social needs; teacher responsibility; New Zealand.

00074 - **Science education and national development.** Madras, India, ICSU-COSTED, 1979. p. 9. (COSTED newsletter; IV, 2) (eng). // International Council of Scientific Unions. Committee on Science and Technology in Developing Countries // Seminar on Science Education and National Development, Ibadan, Nigeria, 1979

The report focuses on the generation of public understanding of science and technology.

Keywords: education and development; science popularization; science and development - scientific literacy.

00075 - **Science education in Europe at secondary school level.** Gibb, M. Belgium, ICASE, 1979. p. 5-9. (ICASE newsletter; VI, 4) (eng). // International Council of Associations for Science Education

An article arising from a round-table discussion in Luxembourg, at which participants reported practices, attitudes and constraints in eight countries. Similarities and differences are of interest, and the article ends by pointing out the close relationship between science teachers associations and curricular reform.

Keywords: curriculum development; comparative education; Western Europe.

00076 - **A Science teaching project in the primary school in Norway.** Johansen, O.E. Geneva, Advisory Committee on Physics Education of the European Physical Society, 1979. p. 11-12. (Europhysics education news; 7) (eng). // European Physical Society. Advisory Committee on Physics Education

"Meet Nature" is an adaptation of SCIS. Important features of primary science curricula are summarised.

Keywords: primary school curriculum; Norway; USA.

// "Meet Nature" (Norway) // Science Curriculum Improvement Study (USA)

00077 - **SLIP kits.** Coombes, S.D. Hatfield, UK, ASE, 1979. p. 28-40. (School science review; LXI, 214) (eng). // Association for Science Education (UK)

The article describes how groups of teachers went about making teaching packages, with help from industries.

Keywords: technology; learning modules; teaching materials; industry and education; UK - teacher role.

// "Science Lessons from Industrial Processes" (UK)

00078 - **Soaps and detergents: a "social" treatment.** Rust, R.C. Hatfield, UK, Association for Science Education, 1979. p. 635-641. (School science review; 213) (eng). // Association for Science Education (UK)

Soap lends itself to a "social" treatment without disturbing the overall framework of any chemistry or integrated science course. This article provides a number of interesting facts and a teaching approach which should take only one or two periods.

Keywords: chemistry education; teaching materials; experiments (lessons); teaching methods; secondary school curriculum; UK.

00079 - **Spreading the message.** Harris, J. London, Institute of Physics, 1979. p. 432-433. (Physics bulletin; xxx, 10) (eng). // Institute of Physics (UK)

October 1979 was designated 'International Energy Conservation Month' and this issue of the Bulletin invited a number of articles on the matter. This article outlines a number of educational programmes developed in Britain, from primary to university and for the public.

Keywords: energy education; science popularization; energy conservation; UK - primary school curriculum; secondary school curriculum; higher education.

// International Energy Conservation Month, October 1979

00080 - **A Survey of the teaching of integrated science in Kaduna State.** Aminu, Dorayi Mohammed. Ibadan, Nigeria, STAN, 1979. p. 88-96. (Journal of the Science Teachers' Association of Nigeria; XVIII, 1) (eng). // Science Teachers' Association of Nigeria

The survey was based on a questionnaire to teachers, and embraced teacher qualifications and experience, proportion of timetable allocated to integrated science and practical work, teaching methods and textbooks. The writer concluded that a pressing need was inservice and preservice teacher education programmes, as well as programmes for training of school laboratory attendants. The textbooks need revision.

Keywords: curriculum evaluation; Nigeria - teacher effectiveness; teacher education; inservice teacher education; activity learning; school laboratories; textbooks.

00081 - **Third international conference on integrated science education.** Becht, Paul A.; Gadsden, Thomas. London, Taylor and Francis, 1979. p. 109-112. (European journal of science education; I, 1) (eng).

A summary of the proceedings of the 1978 Nijmegen Conference. There is a list of the working group papers and their authors. Comments on the problems of obtaining information on developments, these partly solved by conferences and Unesco's "New trends in integrated science teaching" series.

Keywords: international conferences; information sources; educational trends.

// International Conference on Integrated Science Education Worldwide, Nijmegen, Netherlands, 1978 // "New trends in integrated science teaching"

00082 - **UN Conference on Science and Technology for Development: the importance of education and training.** Malvern, UK, ICSU-CTS, 1979. p. 10-15. (ICSU-CTS newsletter; 3) (eng). // International Council of Scientific Unions. Committee on the Teaching of Science

The paper argues that the healthy growth of science and technology in any country depends critically on the availability of technically and scientifically trained manpower. Transfer of technology demands a scientifically literate public with self-reliance and understanding, and this in turn demands massive reappraisal of existing courses at schools and universities.

Keywords: science and development; scientific personnel training; technology transfer; manpower needs - scientific literacy; technical education; curriculum evaluation; university curriculum; vocational training; science popularization.

00083 - **Wildlife conservation: the need for expansion in education.** Horne, S.D. Hatfield, UK, ASE, 1979. p. 142-146. (School science review; LXI, 214) (eng). // Association for Science Education (UK)

If conservation discussions are to go beyond emotion, they should be associated with scientific knowledge. The first part of the article provides some information; it then goes on to present a powerful plea for more attention to wildlife conservation in classrooms and examination syllabi. Important reading for all science teachers.

Keywords: wildlife protection; conservation of nature; social responsibility; curriculum development; examinations.

1980

00084 - **Applied science: a course for pupils of low educational achievement.** Clegg, A.S.; Morley, M. Hatfield, UK, ASE, 1980. p. 454-463. (School science review; 216) (eng). // Association for Science Education (UK)

A set of modules is outlined in an attempt to teach some science to those who normally *stay away from class or exhibit disruptive behaviour. As a result, attendance rose to above 90% and some pupils gained CSE passes. Certainly worth trying in comprehensive schools.*

Keywords: achievement motivation; low achievers; learning modules; teaching strategies; UK - educational attendance; comprehensive schools; modular instruction.

00085 - **The Assessment of pupils' performance in science education in Japan.** Nishinosono, H. Tokyo, Japan Society of Science Education, 1980. p. 149-161. (Journal of science education in Japan; IV, 4) (eng). // Japan Society of Science Education

The article outlines a variety of techniques for obtaining information about pupils' thinking. Some can be computer-processed, even in the classroom, some are open-ended, all appear to be innovative. This article is for researchers.

Keywords: student evaluation; academic achievement; evaluation methods; Japan.

00086 - **Balanced science approaches.** Winnerah, J. Hatfield, UK, ASE, 1980. p. 24-26. (Education in science; 86) (eng). // Association for Science Education (UK)

The author argues for balanced science courses for all if we are to have an adult population informed about science and technology, and scientists, engineers and technologists informed about all the sciences and educated in the humanities and the arts. Excellent reasons against early specialization are given.

Keywords: general education; scientific literacy; science popularization; specialization; core curriculum.

00087 - **Biomechanics in schools.** Vincent, J.F.V. Hatfield, UK, ASE, 1980. p. 648-663. (School science review; 217) (eng). // Association for Science Education (UK)

Most biological 'materials' are not at all, but structures. Investigation of these can be truly scientific, and therefore demand integration of biology with chemistry and physics. Possibly (and sadly), this article could prove more interesting to physical scientists than to life scientists. Recommended for any A-level or tertiary teacher attempting to make his teaching more scientific.

Keywords: activity learning; biology education; physics education; chemistry education; teaching method innovations; upper secondary education; higher education; UK.

00088 - **Committee on Science and Technology in Developing Countries.** Radhakrishna, R. York, UK, IUPAC Committee on the Teaching of Chemistry, 1980. p. 9-11. (International newsletter on chemical education; 14) (eng). // International Union of Pure and Applied Chemistry. Committee on the Teaching of Chemistry

The Scientific Secretary of COSTED outlines the terms of reference, aims and some of the programmes of the Committee. Although most of its activities seem so far to have been confined to Asia, there seems no reason why science educators elsewhere should not attempt to avail themselves of its help.

Keywords: educational assistance; science and technology; Asia; developing countries. // Committee on Science and Technology in Developing Countries

00089 - **Constraint and autonomy in Australian secondary science education.** Fensham, Peter J. London, Taylor and Francis, 1980. p. 189-206. (Journal of curriculum studies; XII, 3) (eng).

The author claims that the Australian Science Education Project must be one of the most extensively studied curriculum projects in the world, describes the major studies and identifies lessons for further curriculum development in science education in Australia. He argues that curriculum developers have tended to concentrate on individual factors and to ignore social ones where the schooling system is an instrumentality in society as a whole. Further, science curriculum development has a time dimension which leads to gaps between intentions and implementations, as the social scene and schools undergo rapid change.

Keywords: curriculum development; curriculum evaluation; educational relevance; Australia - lower secondary education; educational trends.

// Victorian Junior Secondary Science Project (Australia) // Australian Science Education Project

00090 - **Continuity and diversity in the classroom**. Williams, Sandra E. Boulder, Colo., Mountainview Publishing, 1980. p. 9-19. (Outlook; 37) (eng).

Described is a teaching methodology which includes enrichment of the students' learning experiences through an integrated approach to curriculum development, using continuity of curriculum as the major objective. The teacher's responsibility in this approach is to point out patterns and explore and talk about patterns included in the students' experiences.

Keywords: educational aims; curriculum development; teaching strategies - primary school curriculum; USA.

00091 - **Designing an assessment system on the principles of criterion-referenced measurement**. Kellington, Steuart H.; Mitchell, Alison C. Hatfield, UK, ASE, 1980. p. 765-770. (School science review; LXI, 217) (eng). // Association for Science Education (UK)

Describes a Scottish system similar to that used by the Caribbean Examinations Council and, much later, by GCSE of England and Wales. The purposes and nature of criterion-referenced assessment are outlined, together with guidelines for carrying out the assessment and using the results.

Keywords: examinations; educational measurement; student evaluation; UK - educational aims.

// Scottish Integrated Science Project (UK)

00092 - **Enrolment trends in science during the 1970s**. Osborne, Roger. Wellington, New Zealand Science Teachers Association, 1980. p. 15-20. (N Z science teacher; 27) (eng). // New Zealand Science Teachers Association

Most of this paper consists of graphs of enrolments in New Zealand in various subjects in forms 5, 6 and 7 (of secondary education). As in other countries, physics and chemistry are low, especially for girls. Interestingly, at Form 5, biology is falling steadily, giving way to 'science', which by 1979 was taken by some 55% of children.

Keywords: upper secondary education; enrolment; elective courses; New Zealand - physics education; chemistry education; biology education; physical sciences; life sciences; girls education.

00093 - **Environmental education: a suggested strategy for Jamaica**. Dutton, R. Kingston, Jamaica, University of the West Indies, 1980. p. 43-63. (Caribbean journal of education; VII, 1) (eng). // University of the West Indies (Jamaica)

This article is introduced by an outline of the worldwide EE movement, followed by a more specific look at the Jamaican situation. The bulk of the article centres on a suggested map of EE in Jamaica, with four components: teacher education, primary and secondary education, adult education and information, and professional and vocational training. There is a bibliography of 87 items.

Keywords: environmental education; Jamaica - teacher education; primary school curriculum; secondary school curriculum; adult education; vocational training; bibliographies.

00094 - **Evaluation in a developing context: constraints on the evaluation of an integrated science course in Ghana**. Lutterodt, Sarah A. Hamburg, Germany FR, Unesco Institute for Education, 1980. p. 90-95. (International review of education; XXV, 1) (eng). // Unesco Institute for Education (Germany FR)

Hard-nosed evaluation was inhibited by many factors familiar to those with similar experiences elsewhere in the Third World. However, a wealth of useful information was obtained, and the author concludes that it is possible to carry out useful evaluation in spite of limited resources. Her experience reinforces arguments for evaluation of the illuminative variety.

Keywords: curriculum evaluation; developing countries; Ghana - secondary school curriculum; evaluation methods.

// Project for Science Integration (Ghana)

00095 - **Evaluation of science curriculum: some instruments**. Mallik, Uptal. New Delhi, NCERT, 1980. p. 17-25. (School science; XVIII, 3) (eng). // National Council of Research and Training (India)

Begins by clarifying some issues of evaluation and lists criteria for judging curricular materials. Goes on to describe how science curriculum analyses are used and carried out. Ends by suggesting a scheme for the Indian context.

Keywords: curriculum evaluation; evaluation methods - India.

00096 - **An Evolving policy for science curriculum.** Heaney, J.C. Hatfield, UK, ASE, 1980. p. 24-26. (Education in science; 90) (eng). // Association for Science Education (UK)

The article discusses the need for the ASE to respond clearly, quickly and authoritatively to initiatives and proposals from elsewhere. He describes progress towards arriving at a policy which reflects the views of the large membership, a process which began with the consulting document, "Alternatives for science education". Principles, aims and concepts are already agreed upon, and are listed in this article.

Keywords: educational policy; educational aims; educational coordination; teacher associations; UK - curriculum development.

// "Alternatives for science education: a consultative document" (UK)

00097 - **Examinations for an integrated science degree programme.** Moss, G.D. London, IoP, 1980. p. 302-306. (Physics education; XV, 5) (eng). // Institute of Physics (UK)

Examinations at an Australian university are analysed for skills tested. Emphases appear to be idiosyncratic and anyway not well related to the skills needed by science graduates.

Keywords: examinations; university curriculum; educational aims; educational testing; higher education; Australia.

00098 - **An Experience in teaching integrated science.** Holbrook, J.B. Hong Kong, HKASME, 1980. p. 111-121. (Journal of the Hong Kong Association for Science and Mathematics Education; VIII, 2) (eng). // Hong Kong Association for Science and Mathematics Education

A non-Chinese speaker undertook a trial to teach science to Form 1 students with a minimal grasp of English. Well-illustrated worksheets were found to be very helpful. The investigation showed that it was possible to teach in English, but whether or not it is desirable is another question. The policy of the Hong Kong Educational Department is criticised. The article is of interest to those concerned with the problem of standard English as a medium of instruction in societies whose vernacular is different.

Keywords: language of instruction; language barriers; classroom techniques - teaching strategies; teaching materials; Hong Kong.

00099 - **Experiments of RECSAM in developing sciences and mathematics instructional materials.** Chin, P.S. Penang, Malaysia, SEAMEO-RECSAM, 1980. p. 15-26. (Journal of science and mathematics education in Southeast Asia; III, 1) (eng). // SEAMEO. Regional Centre for Education in Science and Mathematics

The project features a research base, a systems appoach, and science/mathematics orientation. The objectives of the teaching materials are listed. An example of a unit is given, and development strategies are outlined.

Keywords: mathematics education; primary school curriculum; curriculum development; teaching materials; South East Asia.

00100 - **Heads, hearts and hands: future alternatives for science education.** Fensham, Peter J. Wellington, New Zealand Science Teachers Association, 1980. p. 31-36. (N Z science teacher; 27) (eng). // New Zealand Science Teachers Association

Failure of the "heads" science curricula of the 60s and the "hearts" curricula of the 70s is explained by the fact that neither is like the "hands" or "doing" science that scientists practise. It is argued that once students acquire practical skills in science, in situations meaningful and relevant to them, the effects will be lasting and social responsibility will fall naturally into place. The article is worth reading by secondary and tertiary science educators who see the need to re-appraise curricula.

Keywords: activity learning; educational relevance; educational innovations - secondary school curriculum; curriculum evaluation; university curriculum; educational trends; New Zealand.

00101 - **Identification of science teacher competencies for implementing ISIS minicourse instruction**. Chiappetta, Eugene L.; Collette, Alfred T. New York, John Wiley, 1980. p. 53-58. (Science education; 64, 1) (eng).

Identified and ranked in this study are such teacher competencies for successful implementation of the ISIS program as: uses a variety of instructional strategies, promotes individual instruction, provides humanistic learning environment, controls the classroom, and organizes the classroom to facilitate instruction. The appendix lists affective competencies and personality characteristics.

Keywords: secondary school curriculum; teacher effectiveness; teacher qualifications; teacher behaviour; secondary school teachers; USA.

// Integrated Science Instruction Study (USA)

00102 - **In-service training of teachers including the retraining of teachers of other subjects**. Ramsey, Gregor. London, CASME, 1980. p. 45-57. (Teacher education for national development: the training of science and mathematics educators with special reference to the social context) (eng). // Commonwealth Association of Science, Technology and Mathematics Educators // Commonwealth Association of Science, Technology and Mathematics Educators. South Pacific Regional Seminar, Darwin, Australia, 1980

The paper attempts to clarify issues for discussion in the conference. It includes some research findings on the effectiveness of in-service programmes. In discussion, the group advocated mass and on-going in-service training aims. Practicalities were also suggested.

Keywords: teacher education; retraining; evaluation of education; Oceania; inservice teacher education - education and development; educational aims; distance education.

00103 - **Integrated science unit**. Vella-Zarb, T.A. Waterloo, Ont., University of Waterloo, 1981. p. 11-14. (Chem 13 news; 118-118) (eng). // University of Waterloo (Canada)

The unit is a study of urine, integrates skills aquired in physics, concepts learned in chemistry, principles of health and topics learned in biology. Much of it can be carried out at home. Full details are given for the teacher, and there should be few logistic problems.

Keywords: secondary school curriculum; teaching strategies; experiments (lessons); Canada - student projects; practicums.

00104 - **International environmental education: the myth and the reality**. Aldrich, J.L. London, CASME, 1980. p. 32-39. (Commonwealth Association of Science, Technology and Mathematics Educators journal; I, 1) (eng). // Commonwealth Association of Science, Technology and Mathematics Educators

This article looks back to IEE over a decade, attempts to clarify the concept, and looks forward to a new philosophy of mankind in nature.

Keywords: environmental education; educational cooperation; science philosophy; educational trends - humanism; environmental perception.

00105 - **Marine education**. Washington, NSTA, 1980. 52 p. (Science and children; XVIII, 2) (eng). // National Science Teachers Association (USA)

The whole issue is devoted to marine education and is of interest to anyone teaching primary or junior secondary students.

Keywords: primary school curriculum; lower secondary education; oceanography education; marine education.

00106 - **Nuclear power and the science curriculum**. Scott, W. London, IoP, 1980. p. 286-288. (Physics education; XV, 5) (eng). // Institute of Physics (UK)

The argument is that school science curricula are out of step with technological change in society. While the facts of nuclear progress are taught, the technologies and possible social effects are not. An informed public is needed for decision-making, and a radical change in school science curricula may be needed.

Keywords: new technologies; secondary school curriculum; social responsibility; scientific literacy; UK - nuclear energy; educational relevance.

00107 - **Primary school science.** Douglass, Raphael; Durgadeen, Lucy. St. Augustine, Trinidad and Tobago, University of the West Indies, 1980. p. 10-13. (Social studies education; 17) (eng). // University of the West Indies (Trinidad and Tobago)

An outline of the early stages in the development of SAPATT is followed by a brief account of the preparations of teachers for the Common Entrance science examination. The article ends with six specimen questions, one for each of the Bloom cognitive levels, and an explanation of these levels. Tests specification and content are also given.

Keywords: primary school curriculum; curriculum development; primary teacher education; inservice teacher education; examinations; Trinidad and Tobago.

// Science: a Process Approach for Trinidad and Tobago

00108 - **Problems of innovation in the Japanese science curriculum.** Imahori, Kozo. Tokyo, Japan Society of Science Education, 1980. p. 139-148. (Journal of science education in Japan; IV, 4) (eng). // Japan Society of Science Education

Most of the article deals in general terms with science education in Japan, providing a fair amount of data. The last part of the article claims that interdisciplinary or multidisciplinary curricula are very effective in attaining the important objective of an understanding of nature or natural phenomena, as one's general culture. There is a brief outline of some Japanese integrated science curricula. Teachers' problems are identified.

Keywords: educational innovations; curriculum development; interdisciplinary approach; education and culture; Japan - conservation of nature; teachers.

00109 - **Qualified to teach?** Manuel, D. Hatfield, UK, ASE, 1980. p. 26-27. (Education in science; 86) (eng). // Association for Science Education (UK)

If science teachers are to provide appropriate science education for all, the demands on them require that they should have real intellectual ability and flexibility. This is more likely to be true in the case of biology teachers. Biology graduates are also more likely than other science graduates to be teaching integrated science courses. Implications for the profession are discussed.

Keywords: teacher effectiveness; teacher qualifications; core curriculum - teacher education; biology education.

00110 - **Questions of primary science: important questions which have been asked by teachers, with some practical answers.** Ward, Alan. Hatfield, UK, ASE, 1980. p. 639-647. (School science review; 217) (eng). // Association for Science Education (UK)

The author attempts to describe primary science in a way which will convince teachers that they are capable of teaching it in a way that is faithful to science. Process is emphasised.

Keywords: primary school curriculum; teacher effectiveness; teacher attitudes; skill development - teaching methods; teaching strategies; UK.

00111 - **Science and education.** Renwick, W.L. New Zealand, New Zealand Science Teachers Association, 1980. p. 6-14. (N Z science teacher; 27) (eng). // New Zealand Science Teachers Association

The Director-General of Education reviews curriculum development in New Zealand since 1945, and identifies directions for the future. Blurring of the boundaries between disciplines is projected, and more attention to social responsibility. There is a useful appendix which analyses the contribution of science curricula at various levels to fifteen various aims of education.

Keywords: curriculum development; educational trends; educational relevance; educational aims; New Zealand.

00112 - **Science and society studies in the school curriculum.** Solomon, Joan. Hatfield, UK, ASE, 1980. p. 213-219. (School science review; LXII, 219) (eng). // Association for Science Education (UK)

The article comments on the ASE's consultative document. It considers how to bridge the gap between the schoolchild and his society by using the social dimensions of science. An outline of a proposed syllabus of the SISCON course is given, and a suggestion is made for teachers to implement some of the "Alternatives for science education" from their own experience and endeavours.

Keywords: educational relevance; social values; upper secondary education - teacher associations; teaching strategies; UK.

// "Alternatives for science education: a consultative document" (UK) // Science in a Social Context (UK)

00113 - **Science: breadth, balance and potential in the 11-16 curriculum.** Yeoman, G.D. Hatfield, UK, ASE, 1980. p. 147-152. (School science review; LXII, 218) (eng). // Association for Science Education (UK)

The author takes a critical look at the ASE's consultative document. He then produces a model of curriculum development for the 80s which contrasts with that of the 60s. He believes that the time has come for theory and research to be taken into account, and that teachers are now in a position to select, for their own pupils, from the large amount of curricular materials available.

Keywords: educational trends; secondary school curriculum; curriculum development; educational reform; teacher role; UK - curriculum research.

// "Alternatives for science education: a consultative document" (UK)

00114 - **Science education: further thoughts.** Prestt, Brenda M. Hatfield, UK, ASE, 1980. p. 31-33. (Education in science; 87) (eng). // Association for Science Education (UK)

Facing the problem of teachers, the writer proposes a simple division of science teaching into three stages, which separate out the processes of science. Her experience is that primary teachers will be quite comfortable with stage 1, which incorporates just over half of the hierarchy of processes. It is the higher processes which frighten many teachers, and these would appropriately be left to the secondary level. For the 13-16 level, she proposes a core plus options, the A level syllabuses to be based on the core and nothing else, which would encourage freedom in the options at the earlier stage.

Keywords: teaching strategies; primary school curriculum; secondary school curriculum; teacher attitudes; UK - core curriculum; elective courses.

00115 - **Science for all on trial.** Lambert, E. Norman. Port-of-Spain, Association of Principals of Public Secondary Schools of Trinidad and Tobago, 1980. p. 25-28. (Education forum; I, 2) (eng). // Association of Principals of Public Secondary Schools of Trinidad and Tobago

The first part of this article presents arguments for the integration of science up to 16+. The second part identifies needs of science teachers and makes suggestions for their resolution.

Keywords: upper secondary education; secondary school teachers; secondary teacher education; Trinidad and Tobago.

00116 - **Science report.** McClenan, Vilma. Kingston, University of the West Indies, 1980. p. 5-10. (Science education newsletter; XI, 2) (eng). // University of the West Indies (Jamaica)

A participant at a meeting in Grenada outlines the OAS Project set up in 1974 but seeming to have kept a low profile ever since.

Keywords: science popularization; nonformal education; scientific literacy; educational assistance; Caribbean.

// OAS // Multinational Project for the Development of Strategies to Achieve Scientific Literacy and Technology Awareness in Caribbean Countries

00117 - **Science, society and trends in science education: some thoughts on the development of integrated science in the educational systems of the world.** Manzelli, Paolo. London, Taylor and Francis, 1980. p. 253-260. (European journal of science education; II, 3) (eng; abstr. in fre, ger).

The writer argues that the development of schooling policies, and a science curriculum, must recognise evolving socio-economic circumstances. The science curriculum should have a utilitarian accent on work. No longer should every society follow a science curriculum to produce students with a "specialized limited perspective" which prepares people for narrow roles in a hierarchical social structure. A research-oriented integrated curriculum is required.

Keywords: educational policy; curriculum; socio-economic factors; educational relevance; education and employment - career development; educational research; educational trends.

00118 - **Science-society mini-courses hit home.** Nalence, E.E. Washington, NSTA, 1980. p. 26-28. (Science teacher; XLVII, 6) (eng). // National Science Teachers Association (USA)

A discussion on the utilization of mini-courses to investigate relevant problems and expose students to issues of social concern.

Keywords: social responsibility; teaching strategies; educational relevance; short courses; USA.

00119 - **The Scottish Integrated Science course: a school based study.** Park, J. Stirling, UK, University of Stirling, 1980. (1 v. in various pagings). (eng). (Unpublished M.Ed. thesis). // University of Stirling (UK)

This study deals with an aspect of the revised SIS course: the use of worksheets intended to individualise tasks according to each pupil's ability.

Keywords: lower secondary education; individualized instruction; ability grouping; teaching materials; teaching method innovations; UK - curriculum guides; classroom techniques; curriculum evaluation.

// Scottish Integrated Science Project (UK)

00120 - **The Secondary survey and science.** Hatfield, UK, ASE, 1980. p. 15-22. (Education in science; 86) (eng). // Association for Science Education (UK)

A summary of the Science chapter of a report resulting from an exhaustive inquiry by the Inspectorate into aspects of secondary education in England. Its recommendations would be most useful to science educators anywhere.

Keywords: secondary school curriculum; curriculum evaluation; teaching methods; UK - educational advisers.

// HMI Secondary Survey (UK)

00121 - **The SISCON-in-schools project.** Solomon, Joan. London, IoP, 1980. p. 155-158. (Physics education; XV, 3) (eng). // Institute of Physics (UK)

SISCON was developed for higher education. This article outlines its adaptation for 6th forms, and helps to illuminate what is meant by science in a social context for 6th formers.

Keywords: curriculum development; social needs; sixth forms; upper secondary education; UK.

// Science in a Social Context (UK)

00122 - **Social and economic influences in curriculum change in Japan: case history of environmental education.** Shimazu, Y. Tokyo, Japan Society of Science Education, 1980. p. 167-173. (Journal of science education in Japan; IV, 4) (eng). // Japan Society of Science Education

The writer shows that the Japanese attitude to nature is distinctly different from that of the Western world. He goes on to describe the environmental pollution which has increased so much in Japan, and the environmental issues which have appeared in school social studies and science curricula. This article should interest curriculum developers, science teachers and 6th form general studies students.

Keywords: environmental education; environmental perception; interdisciplinary approach, education and culture; Japan - social studies; general education.

00123 - **Social goals and science education in Japan.** Oki, M. Tokyo, Japan Society of Science Education, 1980. p. 121-127. (Journal of science education in Japan; IV, 4) (eng). // Japan Society of Science Education

The author suggests approaches which could help the achievement of social goals. Deploring the common view that science is remote from the general public, he illustrates how science is based on human thinking, and relates fundamental concepts and daily life experiences. He then turns to memorisation/inquiry and induction/deduction. The article closes by observing that science majors as well as non-science majors need to consider the social implications of science.

Keywords: educational goals; social values; general education; Japan - teaching methods; science philosophy; learning processes; educational relevance.

00124 - **Studies of the cognitive abilities of science teachers in the Philippines.** Acuna, J.E.; Villavicencio, R.R. Penang, Malaysia, Regional Centre for Education in Science and Mathematics, 1980. p. 30-40. (Journal of science and mathematics education in Southeast Asia; III, 1) (eng). // SEAMEO. Regional Centre for Education in Science and Mathematics

An account of studies with teachers of elementary science, integrated science, biology and physics. Factors influencing the ability of teachers to operate at the higher formal level are discussed, and the conclusion is that this ability is affected by the adult's occupation. Some strategies for teacher education are discussed.

Keywords: teacher effectiveness; teacher evaluation; teacher education; Philippines - biology education; physics education.

00125 - **A Study of curriculum development and evaluation in integrated science.** Kirby, D.M. London, Centre for Science Education, Chelsea College, University of London, 1980. 366 p. (eng). (PhD thesis, University of London). // University of London. Chelsea College

A study describing a modular programme for non-matriculation students in Newfoundland. The major aims were to improve students attitudes to science and their science-processed skills, and the conclusion is that the project was successful within the limitations of the evaluation. Features include a topic-centered approach and the use of inexpensive equipment.

Keywords: curriculum development; curriculum evaluation; learning modules; modular instruction; secondary education; Canada - student attitudes; activity learning; educational equipment; curriculum research; academic achievement; learning processes; teaching materials; readability.

00126 - **"Tchirrip...tchichirrip...tseep": an alarm call for primary school science.** Bainbridge, J. Hatfield, UK, ASE, 1980. p. 623-638. (School science review; LXI, 217) (eng). // Association for Science Education (UK)

A heavily documented discussion which, though somewhat disjointed, recognises the problems of teachers rarely perceived by the planners. The fact that teachers do not readily turn to books is emphasised. Much of the article, as illustration, deals with bird studies and could provide ideas for teachers. Different parts of this article will be of interest to different levels of science educators.

Keywords: teacher attitudes; primary school curriculum; teacher education; teaching methods; teacher effectiveness - life sciences; teacher evaluation.

00127 - **The Testing of attitudes.** St. Augustine, Trinidad and Tobago, ASETT, 1980. p. 15-16. (Journal of education in science for Trinidad and Tobago; VIII, 1) (eng). // Association for Science Education of Trinidad and Tobago

A short transcript of part of a meeting discussing the assessment of attitudes in Caribbean Examinations Council Integrated Science. It does not answer questions of concern to teachers involved in attitude assessment.

Keywords: student attitudes; student evaluation; educational aims; upper secondary education; Caribbean.

// Caribbean Examinations Council Integrated Science (Double Award)

00128 - **They're only playing: the problem of primary science.** Whitter, M. Hatfield, UK, ASE, 1980. p. 556-560. (School science review; 216) (eng). // Association for Science Education (UK)

The problem with primary school science is seen to be the chasm between skill oriented curriculum developments for that level and the didactic, 'right answer' science experienced at secondary level by most people - a social perception problem. One solution would be for secondary teachers to join the primary teachers to look at children and pool strenghts.

Keywords: primary school curriculum; skill development; activity learning; educational coordination; secondary school teachers; primary school teachers.

00129 - **Thoughts on the style of primary science.** Ward, Alan. Hatfield, UK, ASE, 1980. p. 418-426. (School science review; 216) (eng). // Association for Science Education (UK)

Suggestions about ways of making primary science more fun for teacher and pupils, spontaneous, integrated with other subjects and awakening a sense of wondering open-mindedness. The article is essentially a random collection of ideas.

Keywords: primary school curriculum; interdisciplinary approach; teaching strategies - interest (learning); activity learning.

00130 - **Unesco handbook for science teachers.** (Guide de l'Unesco pour les professeurs de sciences) Lockard, David; Lowe, Norman K.; Pearson, Robert E.; Reay, Judith; Thier, Herbert. Paris, Unesco; London, Heinemann, 1980. 199 p. (eng; also in fre, spa, jap, gre, mar). // Unesco

The book is a companion volume to the "New Unesco source book for science teachers". The target readership is teachers, education administrators, curriculum planners and teacher educators concerned with upper primary and lower secondary levels. It describes concepts and techniques for making science classes more meaningful and motivating. An appendix intended for debate in teacher education draws on integrated science worldwide.

Keywords: primary education; lower secondary education; teaching methods; teaching guides - science philosophy; history of science; child development; educational psychology; teaching strategies; student evaluation; classroom techniques; school laboratories; educational laboratory equipment; teaching materials; activity learning; evaluation of education; teacher education.

// Aristoteles // Galilei, Galileo // Newton, John // Piaget, Jean

ISBN: 92-3-101666-0 ; 0-435-57970-3.

00131 - **Why science in the primary schools?** Jacobson, Willard J. Kingston, Jamaica, ASTJ, 1980. p. 27-29. (Science journal; I, 1) (eng). // Association of Science Teachers of Jamaica

Giving examples from Jamaica, an American teachers' college professor gives cogent arguments for primary science. Very useful reading for primary teachers reluctant to teach science.

Keywords: primary school teachers; educational aims; general education; Jamaica.

1981

00132 - **Agriculture as science for society - in rural and urban settings.** Blum, Abraham. Malvern, UK, ICSU-CTS, 1891. p. 16-20. (ICSU-CTS newsletter; 7) (eng). // International Council of Scientific Unions. Committee on the Teaching of Science

The article outlines the relationship between Israel's "Agriculture as Environmental Science" and science and society. A Science in Society programme tailor-made for one school system cannot be adopted into another; adapters will be more interested in criteria than in topics and activities, and the article lists some criteria found most useful for the societal facets of the AES.

Keywords: agricultural education; environmental education; curriculum development; Israel.

// Agriculture as Environmental Science (Israel)

00133 - **Aims of the science teacher.** Limerick, Ireland, Thomond College of Education, 1981. p. 21-22. (Chemistry in action!; 4) (eng). // Thomond College of Education (Ireland) // Irish Science Teachers Association

This concise list and justification is intended to guide the young teacher, to serve as a checklist for the older teacher and to help the Irish Science Teachers Association to ensure sound science education.

Keywords: educational aims; curriculum guides; Ireland.

00134 - **Astronomy as a vehicle for motivation in science education.** Stahl, Philip A. College Park, Md, International Astronomical Union, 1981. p. 7-10. (Astronomy newsletter; 9) (eng). // International Astronomical Union Commission

A teacher in Barbados describes how children responded much more enthusiastically than their teachers to approaches from the Barbados Astronomical Society and eventually formed a Student Astronomy Club. He also uses "the Father of Sciences" to motivate and integrate in his teaching for Caribbean Examinations Council integrated science. He observed that science educators tend to anticipate children's interests within our own *frame of reference.*

Keywords: astronomy; teaching strategies; interest (learning) - upper secondary education; out of school education; Barbados; Caribbean.

// Barbados Astronomical Society // Caribbean Examinations Council Integrated Science (Double Award)

00135 - **British science curriculum projects: how have they taken root in schools?** Tall, Graham. London, Taylor and Francis, 1981. p. 17-38. (European journal of science education; III, 1) (eng; abstr. in ger, fre).

Reviews the uptake of major curriculum development projects in science from the Nuffield programmes of 1962 to 1980, and includes major Schools Council and some local projects. The writer advances the thesis that whilst dissemination and after-care are essential, they are not sufficient to ensure uptake. The prime factors are a positive atmosphere to innovation and the development of ideas and materials seen by the teachers to be both relevant and relatively inexpensive.

Keywords: curriculum development; curriculum evaluation; educational innovations; teacher role; UK.

// Nuffield Junior Science (UK) // Schools Council Science 5-13 Project (UK) // Nuffield Combined Science (UK) // Nuffield Secondary Science (UK) // Schools Council Integrated Science Project (UK)

00136 - **Changes in students' attitudes towards science in the transition between Australian elementary and secondary schools.** Power, Colin. New York, John Wiley, 1981. p. 33-39. (Journal of research in science teaching; XVIII, 1) (eng). // National Association for Research in Science Teaching (USA)

A study which measured 516 students' attitudes to science twice in their last year of primary schools and again after tansfer to secondary schools. The majority of students enjoyed science at both levels and there was no sharp drop-off in attitude as the secondary year progressed. It would appear, however, that students tranferring from primary schools where they had been actively involved in science activities into secondary schools with a non-involving programme suffered a drop-off in attitude.

Keywords: student attitudes; primary school students; secondary school students; Australia - activity learning; interest (learning).

00137 - **Children learning through science**. Richards, R. Hatfield, UK, ASE, 1981. p. 31-34. (Education in science; 92) (eng). // Association for Science Education (UK)

An outline of the strategies behind a Schools Council project for primary science. The main feature is flexibility, and the author claims that the materials have proved readily acceptable to teachers.

Keywords: primary school curriculum; curriculum guides; curriculum development; teacher attitudes; UK.

// Schools Council Children Learning Through Science Project (UK)

00138 - **Children's attitudes towards science**. Johnson, R.T. Washington, NSTA, 1981. p. 39-41. (Science and children; XVIII, 5) (eng). // National Science Teachers Association (USA)

Refers to a study which samples 72,000 students. This article examines the results obtained from the attitudes to science scale that was administered along with the achievement tests. The results are both surprising and depressing. The National Science Foundation funded programmes are used in so few schools that they have clearly had minimal impact. Some consideration is given to ways in which attitudes can be improved.

Keywords: student attitudes; achievement tests; USA - curriculum evaluation; teaching strategies; academic achievement.

// National Science Foundation (USA) // National Assessment of Education Progress, 1976-1977 (USA)

00139 - **The Cognitive demands of WISC: can the match be improved?** Adey, Philip S. Kingston, Jamaica, University of the West Indies, 1981. p. 1-25. (Caribbean journal of education; VIII, 1) (eng). // University of the West Indies (Jamaica)

The writer outlines how a method of analysing cognitive demands of curricula was validated, and summarises the demand levels. A mismatch between the West Indies Science

Curriculum (WISC) and West Indian children was found. Possible required strategies are discussed.

Keywords: curriculum evaluation; academic achievement; Caribbean - teaching strategies; learning processes.

// West Indies Science Curriculum (Trinidad and Tobago)

00140 - **Cognitive style and developing attitudes in the SCIS classroom.** Waring, C. New York, John Wiley, 1980. p. 73-77. (Journal of research in science teaching; XVIII, 1) (eng). // National Association for Research in Science Teaching (USA)

An investigation into possible relationships between field-dependence-independence and scientific attitudes of 353 6th grade New England children who had used SCIS for four years. The Motz scale of attitude towards science and scientists and the Group Embedded Figures Test were used. No statistically significant relationships were found.

Keywords: primary school curriculum; student attitudes; psychological tests; educational psychology; USA.

// Science Curriculum Improvement Study (USA)

00141 - **A Common core in science? Two points of view.** Waring, M.; Schofield, Beta; West, Richard. Hatfield, UK, ASE, 1981. p. 215-236. (School science review; 223) (eng). // Association for Science Education (UK)

Although in a British context, the article explores many fundamental issues in education of concern everywhere. Both parts of the article stress that the idea of a common core and equality in education have profound implications and will not be easily achieved. Waring and Schofield explore a number of models (apples, mushy bananas and pips in pomegranate) and conclude that core science might be possible in some form. West, from a much more subjective position, regards the notion as dangerous and pernicious nonsense. Since the core is likely to be derived from existing syllabuses, it will simply contribute to hardening of the arteries; a far more radical reconstruction of the school curriculum is required if human and social needs are to be met.

Keywords: core curriculum; general education; educational policy; curriculum development; UK - educational innovations; educational relevance; specialization.

00142 - **CXC integrated science: an appraisal.** Reay, Judith. Port of Spain, Association of Principals of Public Secondary Schools of Trinidad and Tobago, 1981. p. 13-18. (Education forum; I, 4) (eng). // Association of Principals of Public Secondary Schools of Trinidad and Tobago

The concept of an integrated approach to science teaching is explained and Caribbean Examinations Council Integrated Science (Double Award) examined in this Context. The strenghts and weaknesses of CXC integrated science are assessed and alternatives examined.

Keywords: evaluation of education; curriculum evaluation; Caribbean.

// Caribbean Examinations Council Integrated Science (Double Award)

00143 - **Definition, design, utilization: some problems associated with integrated science curricula with special reference to the Project for Science Integration in Ghana.** Lutterodt, Sarah A. Hamburg, Germany FR, Unesco Institute for Education, 1981. p. 301-314. (International review of education; 27, 3) (eng). // Unesco Institute for Education (Germany FR)

Teachers face difficulties in utilizing integrated science curricula worldwide. The author believes that problems result from a lack of provision in definition, and identifies three kinds of dilemma: (a) how far experience can be incorporated before beginning to sacrifice conceptual unity (b) how pupils' understanding of the theoretical implications of practical activities can be achieved (c) how the varying results of individual pupils' experience can be adapted to the successful teaching of prescribed objectives. She stresses the need for a realistic assessment of integrated science teaching over the last decade.

Keywords: secondary school curriculum; evaluation of education; curriculum development; curriculum evaluation; Ghana - conceptualization; practicums.

// Project for Science Integration (Ghana)

00144 - **The Development of an integrated science information scheme.** Blum, Abraham. London, Taylor and Francis, 1981. p. 1-15. (European journal of science education; III, 1) (eng; abstr. in fre, ger).

Towards an information network on integrated science development programmes worldwide, especially in developing countries, a group of science educators developed the INCISE scheme including the testing and development of an instrument.Compared with International Clearinghouse Reports, the scheme aims to be (1) more objective (2) more detailed (3) more even in geographical coverage. Testing of this instrument aimed at inter-scorer consistency. A revised form is appended to the article with a recommendation for large-scale testing and comparative analysis of the results towards futher improvement.

Keywords: international information systems; educational information systems; questionnaires; curriculum development; curriculum research - educational cooperation.

// International Network of Centres for Integrated Science Education

00145 - **The Dilemma of the environmental educator: are we really needed? Some answers and examples in the affirmative.** Newman, Peter W.G. London, Taylor and Francis, 1981. p. 109-122. (Environmental education and information; I, 2) (eng).

Examines the structure of environmental education and defines the discipline as an integration of three streams: environmental sciences (physical and natural sciences), and environmental engineering (engineering sciences). Describes four integrating problem-oriented courses offered at Murdoch University in Western Australia.

Keywords: university curriculum; higher education; environmental education; Australia - engineering education; interdisciplinary approach; physical sciences; social sciences.

// Murdoch University (Australia)

00146 - **Do teachers rate science attitude objectives as highly as cognitive objectives?** Schibeci, R.A. New York, John Wiley, 1981. p. 69-72. (Journal of research in science teaching; XVIII, 1) (eng). // National Association for Research in Science Teaching (USA)

A study showed that Western Australian high school teachers gave strongly positive answers to the question.

Keywords: educational aims; student attitudes; motivation; academic achievement; secondary school teachers; Australia.

00147 - **Earth science in New Zealand secondary schools.** Vallender, G.D. Wellington, New Zealand Science Teachers Association, 1981. p. 5-11. (N Z science teacher; 29) (eng). // New Zealand Science Teachers Association

The writer's view is that earth science does not receive the attention in schools that this expanding science deserves. The article includes a suggested scheme. The emphasis is on upper school.

Keywords: earth sciences; upper secondary education; geology education; curriculum development.

00148 - **The Earth sciences and the core curriculum: a case for consideration.** Perrin, M.; Thompson, D. Hatfield, UK, ASE, 1981. p. 29-31. (Education in science; 95) (eng). // Association for Science Education (UK)

There has been increasing awareness that the earth sciences should be included in general education to 16+. Quoting extensively from a Royal Society publication, this article answers the questions "What is earth science?" and "What use is it?"

Keywords: earth sciences; general education; geology education; secondary school curriculum; UK.

// Royal Society (UK)

00149 - **Education through science: the policy statement of the Association for Science Education, 1981.** Hatfield, UK, ASE, 1981. p. 5-52. (School science review; 222) (eng). // Association for Science Education (UK)

This policy has been gestating for several years. Its components are (1) the place of science in the school curriculum (2) the development of the school science curriculum, including pedagogic implications of science for all, assessment and resources (3) implementation. The summary on pp 45-47 is usefully cross-referenced to the rest of the statement. Although the statement refers only to the UK, it will be of value to planners *and anyone reflecting on his own contribution to science education, perhaps in teacher education programmes. The summary is also published in Education in Science, 93 (June 1981).*

Keywords: educational policy; curriculum development; general education; teacher role; UK - student evaluation; educational resources; educational planning.

00150 - **The Effects of single sex and coeducation on science subject preferences and choices at 14+.** Ormerod, M.B. Hatfield, UK, ASE, 1981. p. 553-555. (School science review; 220) (eng). // Association for Science Education (UK)

Another survey which seems to show that each subject is assigned a gender, chemistry and physics being extremely "male", and biology mildly "female". With girls, there is some correlation with perceived "easiness". Since children are generally asked to make subject choices at puberty, the choice may be no more rational than an assertion of sex. The solution appears to be a balanced curriculum up to 16+.

Keywords: sex stereotypes; elective courses; student attitudes; secondary school curriculum - physics education; chemistry education; biology education; core curriculum; general education; coeducational schools; sex role; UK.

00151 - **ESTEAM: a curriculum development for exceptionally able children in science.** Screen, Peter. Hatfield, UK, ASE, 1981. p. 350-355. (School science review; 223) (eng). // Association for Science Education (UK)

A summary report of summer schools for 12-13 years olds thought to be in the top 2% of their age group. It is preceded by a discussion of the characteristics of the gifted child in science, and strategies for meeting his needs.

Keywords: gifted students; ability; lower secondary education; teaching strategies; UK.

00152 - **Evaluating school laboratory skills.** Lunetta, V.N.; Hofstein, Avi; Giddings, Geoff. Washington, NSTA, 1981. p. 22-25. (Science teacher; XLVIII, 4801) (eng). // National Science Teachers Association (USA)

The assessment of cognitive achievement is routinely done by most teachers. Practical-based questions are in the minority, however, and this article may help teachers to include a different type of evaluation procedure in their work.

Keywords: activity learning; school laboratories; practicums; evaluation methods; student evaluation.

00153 - **An Evaluation of the Nigerian Integrated Science Project.** Jegede, Olugbemiro Johnson. Malvern, UK, ICSU-CTS, 1981. p. 26-27. (ICSU-CTS Newsletter; 8) (eng). // International Council of Scientific Unions. Committee on the Teaching of Science

A synopsis of a PhD study. It could be of interest to those concerned about the success of integrated science in general and in Nigeria in particular.

Keywords: curriculum evaluation; lower secondary education; Nigeria.

// Science Teachers Association of Nigeria // Nigerian Integrated Science Project

00154 - **An Evaluation of the Nigerian Integrated Science Project (NISP).** Jegede, Olugbemiro Johnson. Wales, UK, University of Wales, 1981. 321 p. (eng). (Thesis submitted in candidature for the degree of Ph.D of the University of Wales). // University of Wales (UK)

The study focuses on the achievement of the Project's objectives as expressed by the teachers involved; and determines the performance in, and attitude towards, integrated science by the students. Results suggested that integrated science teachers were not favourably disposed towards the Project (due to the lack of appropriate training) and the achievement of cognitive objectives was below expectations. On the other hand, the majority of students had developed positive attitudes towards science through NISP. However, a significantly negative association between attitude towards science and achievement in science was found. Location of school (rural/urban), sex and socio-economic background were found to be correlates of achievement in, and attitudes towards, integrated science. The majority of students found NISP books very difficult to understand, and readability indices indicated that the books were far too advanced for the students for whom they were meant.

Keywords: evaluation of education; educational projects; project evaluation; Nigeria -

lower secondary education; teacher attitudes; student attitudes; teacher education; readability; textbooks; academic achievement.
// Nigerian Integrated Science Project

00155 - **Guidelines for early primary science education (5-10 years): concepts and lesson contents**. Ward, Alan. Hatfield, UK, ASE, 1981. p. 540-545. (School science review; 220) (eng). // Association for Science Education (UK)

"Science 5-13" is rather too voluminous for teachers to find their way around quickly. This author identifies concepts to be taught, and suggests ideas for developing them.

Keywords: primary school curriculum; concepts; teaching strategies; lesson plans; UK.
// Schools Council Science 5-13 Project (UK)

00156 - **History and philosophy in school science**. Sherratt, W. J. Hatfield, UK, ASE, 1981. p. 3-71. (School science review; 223) (eng). // Association for Science Education (UK)

This letter observes that the history and philosophy of science as a means of humanizing and liberalizing school science courses has been urged since the beginning of this century. He suggests that more positive action is now needed.

Keywords: science philosophy; history of science; humanism; curriculum development; educational innovations.

00157 - **The implications of the "Science in Society" project**. Buttle, J.W. Hatfield, UK, ASE, 1981. p. 187-188. (School science review; 222) (eng). // Association for Science Education (UK)

The writer of this letter is critical of what he identifies as a failure to recognise differences in human values in a study of society. He also feels that other subject teachers should have been involved. In short, he appears to believe that the values throughout the course are those of the scientific "establishment".

Keywords: upper secondary education; social values; humanism; interdisciplinary approach; UK.
// "Science in Society" (UK)

00158 - **Instruction and science learning: a quantitative synthesis**. Boulanger, F.D. New York, John Wiley, 1981. p. 113-121. (Journal of research in science teaching; XVIII, 2) (eng). // National Association for Research in Science Teaching (USA)

Many studies have been done on the quality and quantity of science instruction. This article quantitatively synthesises much of this work over the 1963-1978 period. There is an extensive bibliography.

Keywords: educational quality; teaching methods; learning processes; educational trends; USA; bibliographies.

00159 - **An integrated approach to energy education**. Klaus, M. Washington, National Science Teachers Association, 1981. p. 8-9. (Science and children; XVIII, 8) (eng).

A description of a third grade energy programme which involves mathematics, social studies, economics, household management. It could easily contain lots more.

Keywords: energy education; primary school curriculum; USA.

00160 - **An integrated lesson on lead**. Lambert, E. Norman. St. Augustine, Trinidad and Tobago, ASETT, 1981. p. 9-10. (Journal of education in science for Trinidad and Tobago; VIII, 2) (eng). // Association for Science Education of Trinidad and Tobago

A short transcript of a lesson conducted by students with minimal teacher input, and illustrating the kinds of interaction possible, and issues raised in an integrated approach to science.

Keywords: upper secondary education; teaching strategies; peer teaching; activity learning; discussion (teaching method); Trinidad and Tobago.

00161 - **Integrated science unit, pt. 2**. Vella-Zarb, T.A. Waterloo, Ont., University of Waterloo, 1981. p. 4-6. (Chem 13 news; 119) (eng). // University of Waterloo (Canada)

The final part of a study on urine, which integrates skills acquired in physics, *concepts learned in chemistry, principles of health and topics learned in biology. Much of it can be carried out at home. Full details are given for the teacher, and there should be few logistic problems.*

Keywords: secondary school curriculum; teaching strategies; teaching materials; Canada - student projects; practicums.

00162 - **Interrelating science with other subjects.** Main, E.D. Washington, NSTA, 1981. p. 26-27. (Science and children; XVIII, 5) (eng). // National Science Teachers Association (USA)

A brief but interesting description oh how a third grade class involved a wide variety of subjects in a unit on 'the solar system'. With a little imagination on the part of a teacher, such things are surprisingly easy to organize, and allow for enrichment of many subjects.

Keywords: primary school curriculum; interdisciplinary approach; teaching strategies; general education; USA.

00163 - **The Nuclear debate: examination of the issues.** Ellington, H.I.; Addinall, E. London, IoP, 1981. p. 274-281. (Physics education; XVI, 5) (eng). // Institute of Physics (UK)

The article begins with projections about Britain's energy consumption and fuels available, indicating that there is no alternative to the eventual dependence on fast reactors. For other countries, the data would not apply, although the ideas would. The article then goes on to present, without comment, the views of opponents and protagonists of nuclear energy generation. The article would be suitable for 6th form science and non-science students, and could form the basis of a debate. The authors have developed a teaching package for just this purpose.

Keywords: energy education; energy sources; nuclear energy; sixth forms; discussion (teaching method) - social needs; upper secondary education; teaching strategies; learning modules; teaching materials; UK.

00164 - **Nuffield Combined Science: teams for the seventies, themes for the eighties.** Holford, Derek. Driffield, UK, Studies in Education, 1981. p. 38-42. (Education 3-13; IX, 4) (eng).

Appraises new Nuffield Combined Science materials (themes) for teachers of children aged 9-11. Reflects on teaching tactics for the 80s. Suggests reasons for the popularity of the Combined Science course and also for the introduction of the Themes. He suggests a less radical shift in teaching style than discovery learning and guided discovery, and favours a curriculum focused more on the enrichment and mastery of concepts.

Keywords: primary school curriculum; curriculum guides; educational aims; teaching strategies; classroom techniques; UK - heuristic method (teaching); direct method (teaching); concepts; teacher attitudes; activity learning.

// Nuffield Combined Science Themes for the Middle Years (UK)

00165 - **Origins and significance of the science, technology and society movement.** Roby, Keith R. Clayton, Australia, Monash University, 1981. p. 37-43. (Australian science teachers journal; 27, 2) (eng). // Monash University (Australia)

The significance of the inclusion of subject matter pertaining to science, technology and society (STS) in the science curriculum is examined and discussed.

Keywords: biology education; educational aims; secondary school curriculum; technology - curriculum development; educational relevance; Australia.

00166 - **Performance of some Nigerian pupils on some selective concepts in integrated science.** Oyeneyin, A.M.; Balogun, T.A. Ibadan, Nigeria, STAN, 1981. p. 104-111. (Journal of the Science Teachers' Association of Nigeria; XX, 1) (eng). // Science Teachers' Association of Nigeria

A small study of Class 2 pupils which found that achievement at lower cognitive levels was significantly better than at higher levels. No significant differences were found among ease of mastering the various concepts.

Keywords: lower secondary education; academic achievement; concepts; learning processes; Nigeria.

00167 - **Physics for none to 16?** Archenhold, W.F. London, IoP, 1981. 193 p. (Physics education; XVI, 4) (eng).

Expressing his concerns for children and for child-centred teaching, the author appears to support specialist sciences rather than integration.

Keywords: physics education; educational aims; UK.

00168 - **Primary science curriculum development in Africa: strategies, problems and prospects with particular reference to the 'African Primary Science Programme'.** Bajah, Sam Tunde. London, Taylor and Francis, 1981. p. 259-269. (International journal of science education; III, 3) (eng; abstr. in fre, ger).

Discusses problems of introducing the African Primary Science Programme (APSP) in Anglophone African states and its implication for science education in Africa. The background and characteristics of APSP are given and the account of its development is interesting.

Keywords: primary school curriculum; curriculum development; educational innovations; English speaking Africa.

// African Primary Science Programme

00169 - **A Reflection on some meanings of 'interdisciplinary' and 'integration among the sciences'.** Arca, M.; Vicentini-Missoni, M. London, Taylor and Francis, 1981. p. 117-126. (European journal of science education; III, 2) (eng; abstr. in fre, ger).

After the Nijmegen International Conference in 1978, these researchers found it necessary to struggle with the concepts embodied in these and similar terms and thus to clarify needs of science education, starting with primary children.

Keywords: interdisciplinary approach; concepts; educational philosophy; science philosophy - educational needs; primary school curriculum.

00170 - **A Sandwich course for primary science.** Brown, C. A. Hatfield, UK, ASE, 1981. p. 342-343. (School science review; 223) (eng). // Association for Science Education (UK)

This article describes a strategy in one area of England. It arose from the expressed needs of teachers for help in clarifying what is expected of them and in disseminating appropriate science teaching in their own schools. The support of administrators is required, not least for the release of teachers for the college parts of the course. There has so far been no evaluation.

Keywords: primary school curriculum; primary teacher education; inservice teacher education; UK.

00171 - **The School curriculum.** Black, Paul J. London, IOP, 1981. p. 201. (Physics bulletin; XXXII, 7) (eng). // Institute of Physics (UK)

The author, a scientist and a science educator, discusses the quandary of science for all up to 16 while at the same time selecting and training the most talented. He proposes a new type of curriculum - a core about science and scientists, and a spectrum of options.

Keywords: core curriculum; secondary school curriculum; educational aims; elective courses; student selection; gifted students; UK.

00172 - **The School curriculum: a response.** Chapman, B.R. London, IoP, 1981. p. 348. (Physics bulletin; XXXII, 11) (eng). // Institute of Physics (UK)

The writer believes that recent British proposals for restructuring the curriculum are a rear view which take no account of developments in society. He suggests a 13-16 structure in which there are more courses studied for shorter periods, e.g. one-term courses on science and sport, science and music, physics/technology. Then there would be no need to make science compulsory for everyone. In "Phys. Bull., 33,1 (January 1982), 7, R.G. Cawthorne comments critically. He is attracted by much in Chapman's proposals, but points out that they will have to be more carefully marshalled. And in "Phys. Bull., 33, 2 (Febuary 1982), 44, C.A. Crofts argues that employers and all levels of higher education would not be satisfied by such a course.

Keywords: curriculum development; upper secondary education; core curriculum; interdisciplinary approach; UK - education and employment.

00173 - **Science and mathematics in school: towards an interdisciplinary approach.** Ingle, Richard B.; Turner, Anthony D. Hatfield, UK, ASE, 1981. p. 31-33. (Education in science; 93) (eng). // Association for Science Education (UK)

Teachers are well aware that pupils have difficulty transferring their learning in mathematics to their science studies. Yet few schools have done anything about integrating policy and teaching for science and mathematics. Some resources are mentioned, and the article ends with a plea for integration at the teacher education level.

Keywords: mathematics education; interdisciplinary approach; curriculum development; teacher education - educational coordination; educational resources; teacher education curriculum.

00174 - **Science and society in the Australian senior secondary school.** Fensham, Peter J. Malvern, UK, ICSU-CTS, 1981. p. 23-25. (ICSU-CTS newsletter; 8) (eng). // International Council of Scientific Unions. Committee on the Teaching of Science

A brief account of the emphasis in the Australian physical science curriculum, "Man and the Physical World". Uptake and modification in some Australian states is mentioned.

Keywords: physical sciences; upper secondary education; Australia - curriculum development.

// "Man and the Physical World" (Australia)

00175 - **Science curricula: what for?** Shepard, R. Penang, Malaysia, SEAMEO-RECSAM, 1981. 3 p. (Regional centre for education in science and mathematics news; 42) (eng). // SEAMEO. Regional Centre for Education in Science and Mathematics

A specialist in curriculum design suggests that the main learnings in South East Asia school science are the "hidden" curriculum: the ability to tolerate boredom, to accept unquestioningly the statements of authority figures, that schooling is irrelevant to everyday life, etc. In this region as in Western countries, there are few attempts to state the objectives of science education in terms of national goals. Giving some examples of approaches that could be related to national goals, he suggests that South East Asia could develop indigenous curricula which produces autonomous, informed citizens and which could provide a lead for Western countries.

Keywords: science and development; curriculum development; education and development; South East Asia - teaching methods; teacher effectiveness; educational relevance; civic education.

00176 - **Science in a changing society.** Ventura, A.K. Kingston, Jamaica, ASTJ, 1981. p. 25-30. (Science journal; II) (eng). // Association of Science Teachers of Jamaica

The Executive Director of Jamaica's Scientific Research Council describes science as he sees it, and its relationship to society in poor tropical countries like Jamaica. He identifies the emphases needed. Original and creative specialists are needed, as well as a logical and a broad minded population. School courses in science need to include its history, its philosophy, its evolution, its contemporary failings and its future, and must be taught as a method of inquiry.

Keywords: educational goals; science and development; curriculum; social needs; developing countries - science and development; education and development; biotechnology; history of science; science philosophy; Jamaica.

00177 - **Science in men's society**. Harding, Jan. Hatfield, UK, ASE, 1981. p. 368-371. (School science review; 223) (eng). // Association for Science Education (UK)

The "Science in Society materials" are criticised as displaying a massively insensitive and arrogant male interpretation.

Keywords: teaching materials; curriculum guides; sex stereotypes.

// "Science in Society" (UK)

00178 - **The Science in Society course**. Holman, John. York, UK, IUPAC Committee on the Teaching of Chemistry, 1981. p. 14-17. (International newsletter on chemical education; 15) (eng). // International Union of Pure and Applied Chemistry. Committee on the Teaching of Chemistry

This course for sixth form General Studies has been well publicised in various media. Here the article outlines the materials and strategies involved.

Keywords: general education; educational relevance; upper secondary education;

teaching materials; UK.
// "Science in Society" (UK)

00179 - **Science in the primary schools: what went wrong?** Plimmer, D. Hatfield, Uk, ASE, 1981. p. 641-647. (School science review; 221) (eng). // Association for Science Education (UK)

This is an exploration of why primary teachers are so reluctant to teach science. Possible factors identified are ability, style of learning, attitudes to science, and difficulty in understanding scientific literature. Primary science is seen as just one link in a vicious circle of events.

Keywords: primary school teachers; teacher attitudes.

00180 - **The Secondary science curriculum: can we learn anything from primary schools?** Baxter, M. Hatfield, UK, ASE, 1981. 37 p. (Education in science; 92) (eng). // Association for Science Education (UK)

It appears that hardly anyone understands the nature of science, and there is often a mis-match between children and the science they are taught. The very best primary school science may have got it right.

Keywords: secondary school curriculum; primary school curriculum; academic achievement; evaluation of education.

00181 - **Sex-role stereotyping by high school females in science.** Vockell, E.L.; Lobonc, S. New York, John Wiley, 1981. p. 209-219. (Journal of research in science teaching; XVIII, 3) (eng). // National Association for Research in Science Teaching (USA)

An interesting study which shows that while science in general is not viewed by girls as a masculine area, physical sciences are. Interestingly, such sex-role stereotyping is far more likely to occur in co-education schools than in all-girls schools. Some possible reasons for this are discussed.

Keywords: sex stereotypes; student attitudes; secondary school students; physical sciences; girls education - coeducational schools; girls schools.

00182 - **Sex-role stereotyping in science textbooks.** Norman, H.; Hiha, A. New Zealand, New New Zealand Science Teachers Association, 1981. p. 20-21. (N Z Science Teacher; 29) (eng). // New Zealand Science Teachers Association

These women examined 80 books, and found a male bias, stronger in secondary than in primary schools. The writers of the article have not been careful enough to exclude the possibility that they may have been biased themselves. Mary Garlick in a brief note at the end of the article gives advice on ways to counter the sex imbalance in science textbooks.

Keywords: textbooks; sex stereotypes; sex role; New Zealand - educational resources; teaching materials; teaching strategies.

00183 - **The Social implications of science and science choices at 14+.** Ormerod, M.B. Hatfield, UK, ASE, 1981. p. 164-167. (School science review; 222) (eng). // Association for Science Education (UK)

Describes an investigation into attitudes to the social implications of science, subject preference and liking for the teachers. After reporting the findings, the author concludes that the work on the social implications of science should be taken before 14+.

Keywords: social values; cultural values; student attitudes; secondary school curriculum; UK.

00184 - **Some science curriculum notes.** Ferguson, D.; Perris, Lyall. Wellington, New Zealand Science Teachers Association, 1981. p. 34-37. (N Z Science Teacher; 29) (eng). // New Zealand Science Teachers Association

An account of developments in agriculture education and moderation of school-based assessment in modular science.

Keywords: agricultural education; examinations; activity learning; student evaluation; modular instruction; New Zealand.
// New Zealand Modular Science

00185 - **Students tell teachers what they want from school.** Javs, H.H. Washington, NSTA, 1981. 30 p. (Science and children; XVIII, 6) (eng). // National Science Teachers Association (USA)

Reports a study involving 224 teachers and their K-6 students. The teachers felt that they knew what their students wanted from school - they were wrong! Only two of the teachers felt that their students would want to learn or do science or learn about a science related career. None of the K-2 students did, but 27-30% of the 3-6 children did. Girls expressed as much interest in science as did the boys. One wonders how many of the teachers were actually teaching science and, if they were, what sort of science they taught if they felt that their students wouldn't want to learn it.

Keywords: primary school students; student attitudes; teacher attitudes; teacher effectiveness; USA - primary school curriculum; sex stereotypes.

00186 - **A Survey of environmental issues treated in science education curricula, before and after 1974.** Blum, Abraham. New York, John Wiley, 1981. p. 221-228. (Journal of research in science teaching; XVIII, 3) (eng). // National Association for Research in Science Teaching (USA)

Environmental science has become very popular in the last decade or so. Unfortunately, less attention has been paid to training teachers in environmental science education. This survey examines how the USA has met this challenge. It draws on ERIC documentation and the 9th International Clearinghouse Report.

Keywords: environmental education; teacher education; bibliographies; USA.
// Eric (USA)

00187 - **Teaching monitoring of practical work.** Brathwaite, WorkeleyE. Kingston, University of the West Indies, 1981. p. 9-13. (Science Education Centre newsletter; XII, 1) (eng). // University of the West Indies (Jamaica). Science Education Centre

The author is disturbed that, although science programmes place considerable emphasis on practical work, assessment of students does not involve much assessment of practical ability, or assesses invalidly and unhelpfully. Sympathising with teachers of large classes, he suggests strategies by means which teachers can keep informative records.

Keywords: activity learning; practicums; student evaluation; class size; evaluation methods - Caribbean.

00188 - **What is science?** Tunnicliffe, S.D. Hatfield, UK, ASE, 1981. p. 548-550. (School science review; 220) (eng). // Association for Science Education (UK)

A primary teacher gives her view of science in the primary school ("tremendous fun"). She has attempted to deal with too many issues in only two pages, but the article could be useful with student teachers, as a starting point for discussion.

Keywords: primary school curriculum; teacher attitudes; primary school teachers; teacher education.

00189 - **What science would year 7 students like to study: some questions, answers and differences.** Dawson, C.J.; Bennett, N. Parkside, South Australian Science Teachers Association, 1981. p. 13-17. (South Australian Science Teachers Association journal; 813) (eng). // South Australian Science Teachers Association

South Australian students were surveyed to determine what science topics they would prefer to study and how they would like to study them. Results for all students (N=753), boys (N=400), and girls (N=353) are reported for the 15 most popular topics and preferred study method. Includes implications for science instruction.

Keywords: interest (learning); sex stereotypes; student attitudes; Australia - upper secondary education; teaching strategies; study methods.

00190 - **Who cares what school biology is for?** Fawns, Rod. Clayton, Australia, Monash University, 1981. p. 23-29. (Australian science teachers journal; 27, 2) (eng). // Monash University (Australia)

Discussed is the question: "If science curricula reflect actions of pressure groups to include or delete certain content, is science a part of a basic, liberal education?"

Keywords: biology education; curriculum; academic freedom; public opinion - curriculum evaluation; educational aims; general education; secondary education; secondary school curriculum; Australia.

1982

00191 - **Caribbean science education: a decade in review.** King, Winston K. Hong Kong, HKASME, 1982. p. 166-177. (Journal of the Hong Kong Association for Science and Mathematics Education; X, 2) (eng). // Hong Kong Association for Science and Mathematics Education

The account, largely about developments in integrated science, dwells on Caribbean Examinations Council Integrated Science (double Award), on teachers' college assessment in the Eastern Caribbean and on the development of science teachers' associations; and touches on science at 11+ and 14+. Predictions for the 80s are made.

Keywords: curriculum development; educational testing; teacher evaluation; Caribbean - examination boards; teacher associations; teacher education; educational trends.

// Caribbean Examinations Council Integrated Science (Double Award)

00192 - **CXC integrated science: to integrate or not to integrate?** Hill, E. Reading, UK, University of Reading, 1982. p. (eng). (Unpublished M.Ed. dissertation). // University of Reading (UK)

CISC is a set of teaching materials put together by Caribbean educators with the aim of helping teachers and candidates for the first CXC science. The author considers whether CISC and integration would be acceptable to teachers and students in Antigua and Barbuda. He concludes that non-integration at this level is preferable, but at lower secondary level the science should be integrated.

Keywords: specialization; teaching materials; upper secondary education; lower secondary education; Antigua and Barbuda; teaching guides - teacher attitudes; student attitudes; curriculum guides; teaching materials.

// Caribbean Examinations Council // Caribbean Integrated Science Curriculum // CXC Integrated Science (Double Award)

00193 - **Did the exam work? (Part 2).** Phillips, R.F. Hatfield, UK, ASE, 1982. p. 15-19. (Education in science; 99) (eng). // Association for Science Education (UK)

Describes how British 16+ papers in biology and integrated science (1981) were analysed in an attempt to determine whether they matched the general objectives and weightings given in the syllabuses. This analysis raises fundamental issues of examining, including the effects of choice in a paper. It also gives guidelines for conducting a similar exercise locally. (Part 1 in EiS 98, p. 13-17, reported similar analyses for chemistry and physics papers.).

Keywords: upper secondary education; examinations; educational aims; biology education; UK.

00194 - **11-13science in middle schools: common practice or common core?** Allsop, R.Terry; Collins, R.C. Hatfield, UK, ASE, 1982. p. 554-555. (School science review; 224) (eng). // Association for Science Education (UK)

In a small survey these writers found that practice was very similar in the various schools, and showed the same deficiencies (familar to those with experience elsewhere). Rethinking of work at this level is imperative.

Keywords: secondary school curriculum; lower secondary education; teaching methods; core curriculum.

00195 - **An Evaluation of the Nigerian Integrated Science Project (NISP) after a decade of use in the classroom.** Jegede, Olugbemiro Johnson. Hamburg, Germany FR, Unesco Institute for Education, 1982. p. 321-336. (International review of education; 18, 3) (eng; abstr. in fre, ger). // Unesco Institute for Education (Germany FR)

Evaluation instruments included a questionaire, assessment, attitude and readability tests, the subject being 482 teachers and 1894 pupils. Problems revealed lack of appropriate teacher training and low achievement of cognitive objectives, but the majority of children had developed positive attitudes towards science. Areas of concern are identified. The project expects too much from the teachers. Doubt is cast on the validity of readability formulae where English is a foreign language (though the official one). Suggests an explanation for the negative association between achievement and attitude.

Keywords: lower secondary education; project evaluation; educational projects; evaluation of education; Nigeria - teacher attitudes; student attitudes; readability;

language of instruction; academic achievement.
// Nigerian Integrated Science Project

00196 - **Health development through primary health: from theory into practice.** Monekosso, G.L. Kingston, Jamaica, CFNI, 1982. p. 35-40. (Cajanus; XV, 1) (eng). // Caribbean Food and Nutrition Institute

While much time is devoted to "health and hygiene" in the primary schools of the Caribbean, little attention is paid to these at the secondary level. This article outlines the primary health care model and could provide secondary school teachers with some ideas they could discuss with their students.

Keywords: health education; secondary school curriculum; teaching strategies; teaching materials; Caribbean.
// Primary health care model (Caribbean)

00197 - **Integrated science: should any pupils fail?** Heyworth, Rex. Hong Kong, HKASME, 1982. p. 15-18. (Journal of the Hong Kong Association for Science and Mathematics Education; X, 1) (eng). // Hong Kong Association for Science and Mathematics Education

This article is of interest in the context of purposes and strategies of assessment. The core of the argument is that each pupil should be assessed on the basis of a personal set of objectives. The writer also distinguishes between end-of-term and end-of-unit tests.

Keywords: student evaluation; ability grouping - educational testing; educational aims.

00198 - **Integrated science: what do teachers think?** Allsop, R. Terry; Hassanali, Amena. St Augustine, Trinidad and Tobago, Association for Science Education, 1982. p. 1-6. (Journal of education in science for Trinidad and Tobago ; X, 1) (eng). // Association for Science Education of Trinidad and Tobago

Summarises the findings of a study into the attitudes of teachers towards integrated science for the Caribbean Examinations Council. Chemists held the most favorable attitudes, followed by biologists and then physicists. Interpretations are suggested and recommendations are made for improving the status of integrated science.

Keywords: upper secondary education; teacher attitudes; Trinidad and Tobago.
// Caribbean Examinations Council

00199 - **Integrating with science: one way to bring science back into the elementary school day.** Cohen, Herbert; Staley, Frederick. Bowling Green, Ohio, School Science and Mathematics Association, 1982. p. 565-572. (School science and mathematics; LXXXII, 7) (eng). // School Science and Mathematics Association (USA)

The difficulties of elementary school teachers with science are well-known. The writers argue that integrating science with other disciplines should improve the quality and quantity of science instruction by using science topics, units, themes or curricular materials as vehicles for bringing meaning to the study of other academic disciplines. A classified outline of elementary programmes is provided.

Keywords: interdisciplinary approach; primary school curriculum; teaching strategies; teacher effectiveness; educational quality; USA.

00200 - **Junior secondary science revision: how does it fit with what the experts say?** Dale, Terry. Victoria, B.C., British Columbia Science Teachers' Association of the British Columbia Teachers' Federation, 1982. p. 5-6. (The B C science teacher; XXIV, 822404) (eng). // British Columbia Science Teachers' Association (Canada)

The curriculum, initially with its content organised in an integrated fashion, has been modified so that teachers have a choice of an integrated or discipline-oriented approach. The article outlines the flavour of the revised curriculum.

Keywords: lower secondary education; curriculum development; specialization; Canada.

00201 - **Measuring student attitudes: semantic differential or Likert instruments?** Schibeci, R.A. New York, John Wiley, 1982. p. 565-570. (Science education; 66, 4) (eng).

Following descriptions of a semantic differential (SD) and test of science-related attitudes (TOSRA) - a Likert-type scale - reports results of using the instruments with *secondary school students in various Australian schools (N=1 049 for TOSRA and 1 116 for SD). Suggests SD for general attitude and Likert-type scales of specific attitude measurement.*

Keywords: student attitudes; educational measurement; comparative analysis; secondary school students - Australia.

// Test of Science-related Attitudes (Australia)

00202 - **Putting science and society in your classroom.** Beisenherz, P.C. Reston, VA, National Association of Biology Teachers, 1982. p. 180-182. (American biology teacher; XLIV, 3) (eng). // National Association of Biology Teachers (USA)

The need for biology teachers to consider society-oriented topics, those which relate to their students' lives, is emphasized. There is evidence that teachers either believe strongly in content-oriented goals or are unable to implement social goals (i.e those not found in the text). Solutions to the latter part are suggested, general rather than specific. The writer emphasises that if the teacher is to follow these up he must already have a strong commitment. If teachers are unwilling to devote the time and effort to go beyond the text, curriculum innovation is unlikely.

Keywords: social needs; educational relevance; educational goals; teacher effectiveness; teacher attitudes - biology education; curriculum development.

00203 - **Resources for science teaching: report of a survey in the Commonwealth Caribbean.** Reay, Judith. London, Commonwealth Secretariat, 1982. 76 p. (eng). // Commonwealth Secretariat

The survey attends particularly to the teaching of integrated science and physics; as such it would embrace resources for most science teaching. There are sections on science and production, improvisions and improvement, science rooms, audiovisual and printed resources, centres and information sources, servicing of equipment and science teachers associations. Appendices include tables of materials in schools for teaching physics and integrated science.

Keywords: educational resources; educational laboratory equipment; audiovisual aids; school laboratories; Caribbean - teacher centres; physics education; primary education; secondary education; teacher associations; Jamaica; Guyana; Trinidad and Tobago; Barbados.

// University of the West Indies // Caribbean Examinations Council // Jamaica Science Education Centre // University of the West Indies

ISBN: 0-85092-212-7.

00204 - **Science education: a select classified bibliography of Nigerian sources, 1960-1982.** Muogilim, Emma S. Ibadan, STAN, 1982. p. 164-178. (Journal of the Science Teachers' Association of Nigeria; XX, 2) (eng). // Science Teachers' Association of Nigeria

The 350-odd items include 55 higher degree disertations, periodical articles and conference papers. The sections on general issues and integrated science are relatively extensive.

Keywords: bibliographies; theses; Nigeria.

00205 - **Science education for citizens: perspectives and issues.** Gaskell, P. James. Leeds, UK, Leeds University Centre for Studies in Science Education, 1982. p. 33-46. (Studies in science education; 9) (eng). // Leeds University (UK). Centre for Studies in Science Education

The article deals with the interests of various social groups in supporting a thorough revision of the junior secondary science programme in Canada. Attention is drawn to some of the issues in science, technology and society curricula that need to be addressed by science teachers, and to some organisational decisions that need to be made in developing curriculum materials of this type. Deep rooted ethnical and political factors will make it difficult to reach consensus, but teachers must attempt to find answers to the large questions about the social context of science, the political nature of curriculum and what it means to educate a person about a social issue.

Keywords: civic education; educational relevance; pressure groups; lower secondary education; curriculum development; teacher responsibility; Canada.

// Junior secondary science (Canada)

00206 - **Science in society.** Pickup, R.; Lewis, John L.; Payne, V. Hatfield, UK, ASE, 1982. p. 776-779. (School science review; 225) (eng). // Association for Science Education (UK)

These are three letters relating to the ASE's Science in Society materials. One is highly critical, the others are from developers of the materials.

Keywords: upper secondary education; curriculum guides; teaching materials; UK. // "Science in Society" (UK)

00207 - **Science literacy for all students.** Brown, Peggy. Washington, Association of American Colleges, 1982. 19 p. (Forum for liberal education; 5, 1) (eng). // Association of American Colleges

Describes selected college programmes to increase students' science literacy to prepare them for a world of science and technology.

Keywords: higher education; core curriculum; scientific literacy; general education; USA - educational relevance; social needs.

00208 - **16+practical assessment.** Biggs, P. Hatfield, UK, ASE, 1982. 43 p. (Education in science; 97) (eng). // Association for Science Education (UK)

This is a brief report of a survey of English science teachers into their views on school based assessment.

Keywords: upper secondary education; examinations; activity learning; student evaluation; UK.

00209 - **Student teachers' attitudes toward science and science teaching.** Lucas, Keith B.; Dooley, John H. New York, John Wiley, 1982. p. 805-809. (Journal of research in science teaching; XIX, 9) (eng). // National Association for Research in Science Teaching (USA)

Investigated attitudes of Australian elementary school student teachers (N=67) towards science and science teaching. No change in attitude was reported (using Moore and Sutman's Attitude Toward Science Teaching Scales) as a result of taking a content-based science unit, suggesting more effort in fostering desirable attitudes among these teachers.

Keywords: student teachers; student attitudes; teacher attitudes; teaching methods; primary school teachers; preservice teacher education; Australia.

00210 - **Teachers' attitudes to the introduction of integrated science in the fourth year of secondary school in Trinidad and Tobago.** Hassanali, Amena. Oxford, UK, Dept of Educational Studies, St Catherine's College, 1982. 110 p. (eng). (Unpublished thesis for Master of Science in Educational Studies). // St. Catherine's College (UK). Dept of Educational Studies

A study undertaken when the Caribbean Examinations Council Integrated Science (Double Award) was relatively new. Results indicated that attitudes were more favourable among (a) trained than untrained teachers (b) chemistry teachers than biology teachers (c) biology teachers than physics teachers (d) teachers of less able pupils than those of more able pupils.

Keywords: teacher attitudes; secondary school curriculum; educational innovations; curriculum development; Trinidad and Tobago. // Caribbean Examinations Council Integrated Science (Double Award)

00211 - **Teaching about science, technology and society at the secondary school level in the United States: an educational dilemma for the 1980s.** McConnell, Mary C. Leeds, UK, Leeds University Centre for Studies in Science Education, 1982. p. 1-32. (Studies in science education; IX) (eng). // Leeds University (UK). Centre for Studies in Science Education

Summarises some US studies, which show that over the past decade the system of science education in the US has come to be out of harmony with science, the national interest and the needs of the individual. The aims of science education are not understood, and precollege students may receive little or no science courses. Explores attempts to clarify approaches to education about science, technology and society, and exemplifies with some US modules. Closes by identifying some important areas of concern.

Keywords: secondary school curriculum; educational relevance; educational aims; USA - educational trends; individual development; educational needs; learning modules; education and development; secondary school students.

00212 - **Trends in science education and the future of science curriculum in Nigeria.** Oyedum, N.A.; Shuaibu, M.J. Ibadan, Nigeria, STAN, 1982. p. 75-96. (Journal of the Science Teachers' Association of Nigeria; XXI, 1) (eng). // Science Teachers' Association of Nigeria

The article takes an overview of trends worldwide from 1956-57 to 1974-75 in terms of (a) initiation of new projects (b) African projects (c) research and dissertation topics (d) journal articles (USA and UK) by subject (e) themes of new projects in USA and UK. The authors regret that Nigerian science education is influenced, if not dictated, by activity elsewhere. They identify opportunities to face science education problems that are really Nigerian.

Keywords: educational trends; education and culture; curriculum evaluation; Nigeria - educational innovations; educational research; Africa; USA; UK; research priorities.

00213 - **Updating and retraining of science teachers**. Hong Kong, Hong Kong Association for Science and Mathematics Education, 1982. 159 p. (eng). // Hong Kong Association for Science and Mathematics Education // International Council of Associations for Science Education. Asian Symposium, 4th, Hong Kong, 1982

Attention is paid to primary and secondary teachers, to strategies adopted in various countries of Asia, and to teachers of mathematics, science disciplines and integrated science.

Keywords: teacher education; inservice teacher education; Asia - primary teacher education; secondary teacher education; refresher courses; mathematics education.

00214 - **Why do practical work in 11-13 science?** Beatty, J.W.; Woolnough, Brian E. Hatfield, UK, ASE, 1982. p. 768-770. (School science review; 225) (eng). // Association for Science Education (UK)

This article reports the findings from a questionnaire sent to British teachers, and follows up investigations carried out by Kerr and others since 1962. A surprising amount of time was said to be spent on practical work (40-60% was the median, more in comprehensive schools). The most common types of practical work, and the most favored aims, are explored and compared with those of 1962.

Keywords: lower secondary education; activity learning; practicums; educational aims; educational trends; UK - comprehensive schools.

1983

00215 - **Ameliorating current problems in science education.** Gardner, Marjorie H.; Yager, Robert E. New York, John Wiley, 1983. p. 587-594. (Science education; 67, 5) (eng).

Discusses the dangers of quick-fix solutions to the current crisis in science education and the need for a philosophical base and theoretical teaching strategies. Proposes science and mathematics study as requirements for grades K-14 and implementation of a vertically articulated curriculum. Concludes by calling for pluralistic response to the challenge.

Keywords: articulation; curriculum development; educational reform; educational trends; USA - primary school curriculum; secondary school curriculum; higher education; mathematics education.

00216 - **Constraints on the successful implementation of the integrated science programme at the senior secondary level in Nigeria.** Gbamanja, S.P.T. Ibadan, Nigeria, STAN, 1983. p. 72-78. (Journal of the Science Teachers' Association of Nigeria; XXII, 1) (eng). // Science Teachers' Association of Nigeria

Although science teaching in primary and junior secondary schools and teacher education is geared towards integrated science, the senior secondary school segment has been left out. The article examines the feasibility of extending the integrated science programme to this level.

Keywords: upper secondary education; Nigeria.

00217 - **The Development of modular science in Essex and surrounding counties.** Titcombe, A. R. Hatfield, UK, ASE, 1983. p. 619-625. (School science review; 229) (eng). // Association for Science Education (UK)

Gives a brief history of modular science and its development for an examining board. Advantages of the scheme are identified. An outline of the syllabus is given.

Keywords: upper secondary education; learning modules; UK - modular instruction; curriculum development; teaching method innovations; ability grouping.

// "Modular Science" (UK)

00218 - **Educating Americans for the 21st century: a plan of action for improving mathematics, science and technology for all American elementary and secondary students so that their achievement is the best in the world by 1995.** Washington, National Science Board Commission on Precollege Education in Mathematics, Science and Technology, 1983. 124 p. (eng). // USA. National Science Board. Commission on Precollege Education in Mathematics, Science and Technology

The report insists that top priority should be given to retraining and retaining teachers of high quality in mathematics, science and technology and enhancing instruction in these fields in grades K-6. Much more time should be given for these subjects throughout elementary and secondary grades. Implications are explored. Useful appendices include good practices reviewed by the Commission.

Keywords: primary teacher education; secondary teacher education; inservice teacher education; teacher effectiveness; USA - science and technology; mathematics education; curriculum development; teacher recruitment; primary school curriculum; secondary school curriculum; retraining; refresher courses; educational reform.

00219 - **Effects of English language and intellectual ability on performance in integrated science.** Heyworth, Rex. Hong Kong, HKASME, 1983. p. 91-98. (Journal of the Hong Kong Association for Science and Mathematics Education; XI, 1) (eng). // Hong Kong Association for Science and Mathematics Education

Chinese is generally used in class discussion especially with low-ability pupils. New science curricula make new demands. A study on form 2 pupils found that (a) few of the children, especially girls, could think abstractly (b) abstract thinkers (especially girls) do better than concrete thinkers in integrated sciences (c) the most important factor in predicting achievement is English language ability; conventional tests of intelligence show almost no predictive power.

Keywords: language of instruction; language barriers; academic achievement - abstract reasoning; girls education; Hong Kong.

00220 - **Exchange your teaching post and go abroad!** Berry, M.D.S. Hatfield, UK, ASE, 1983. p. 25-26. (Education in science; 104) (eng). // Association for Science Education (UK)

This account is of general interest for its description of the secondary curriculum (and particularly the science aspects) in Western Australia. Inter alia, science is compulsory up to the end of Year 12! Also of interest is the strategy for meeting the needs of children of different abilities.

Keywords: secondary school curriculum; general education; ability grouping; educational policy; Australia - teaching abroad.

00221 - **Integrated science teaching in schools and the new Nigerian policy on education.** Akpan, O.E. Ibadan, Nigeria, STAN, 1983. p. 66-73. (Journal of the Science Teachers' Association of Nigeria; XXI, 2) (eng). // Science Teachers' Association of Nigeria

The article assesses the part to be played by integrated science teaching in the new 3-3-4 education policy which began in 1982. It cites studies undertaken since the inception of the Nigerian Integrated Project about 1970. Generally there have been some successes; however, progress has been painful and the proposals centre on broad efforts to enhance teacher education.

Keywords: secondary school curriculum; core curriculum; educational policy; teacher education; curriculum evaluation; teacher effectiveness; Nigeria.

// Nigerian Integrated Science Project

00222 - **The Issue of sensitive interdisciplinary science-oriented curricula in the social service**. Zoller, Yuri; Weiss, Shoshana. London, Taylor and Francis, 1983. p. 147-155. (International journal of science education; V, 2) (eng; abstr. in fre, ger).

Such curricula are responsive to a social demand for 'relevant' curricula. The illustration given in this paper is "Hashish and Marijuana". Value judgments and decision-making are features, and integration of the cognitive and affective domains is deliberated. Characteristics of and rationale for such programs are listed. The paper also describes how the specimen unit is implemented through "class meetings". Possible problems of acceptability are identified.

Keywords: educational relevance; interdisciplinary approach; social responsibility - learning modules; student attitudes; classroom techniques; discussion (teaching method); Israel.

00223 - **The Nature and problems of curriculum development.** Hamilton, J. Hatfield, UK, ASE, 1983. p. 10-14. (Education in science; 103) (eng). // Association for Science Education (UK)

The Education Permanent Secretary in Britain discusses the need for a central policy and the issues which should be reflected in that policy. Reference is made to a number of recent documents on science education. Although the context is British, the article could be of some interest to educators reflecting on trends in science education.

Keywords: educational policy; curriculum development; educational trends; UK - general education; core curriculum.

00224 - **New trends in primary school education, v.1.** Harlen, Wynne. Paris, Unesco, 1983. 216 p. (The Teaching of basic sciences) (eng; also in ara, fre, spa). // Unesco // Meeting of Experts on the Incorporation of Science and Technology in the Primary School Curriculum, Paris, 1980

The 20 chapters are grouped into 4 sections: aims and constraints; curriculum materials and their development; theory into practice and teacher preparation. There is also a substantial final report which surveys the issues of current significance. Specific accounts of a number of countries are included.

Keywords: primary school curriculum; teaching strategies; primary teacher education; educational trends - educational aims; teaching materials; curriculum development; child development; teaching skills; Brazil; France; Sri Lanka; Indonesia; Bulgaria; Africa.

ISBN: 92-3-102034-x.

00225 - **New trends in school science equipment.** Lowe, Norman K. Paris, Unesco, 1983. 161 p. (eng; also in ara, fre, spa). // Unesco // International Meeting on School Science Equipment, Paris, 1980

This book attempts to provide an overall picture of trends in respect of science equipment, as well as associated problems and factors around the world. Through out the book descriptions of equipment and other resource materials are usually set in the context of curriculum development. The target readership includes teachers, student teachers, teacher educators, research workers, curriculum developers and Ministry of Education officials.

Keywords: educational equipment; school laboratories; educational laboratory equipment; activity learning - curriculum development; educational projects; primary school curriculum; secondary school curriculum; teaching guides; educational expenditure; teacher education; teacher centres.

ISBN: 92-3-102052-8.

00226 - **Organization and integration of learning experiences in a curriculum: a case study.** Everwijn, S.E.M. London, Taylor and Francis, 1983. p. 183-197. (Journal of curriculum studies; XV, 2) (eng).

Describes experience of using the principle of "organizers" from the work of Ausubel, Earl and Tyler in constructing a curriculum which requires students to relate what has been learned in one subject to what is being learned in another. Although the illustrations are from courses for student nurses and in a hotel school, the article could be useful in school science curricula.

Keywords: curriculum development; learning processes; educational psychology; teaching strategies; higher education.

00227 - **Preservice and inservice educaton for science teachers.** Tamir, Pinchas; Hofstein, Avi; Ben-Peretz, M. Rehovot, Israel, Balaban International Science Services, 1983. 634 p. (eng). // International Seminar on Preservice and Inservice Education of Science Teachers, Rehovot, Ein Gedi and Jerusalem, Israel, 1983

The book is organized so that conference papers are pulled together into eight coherent chapters with the following themes: problems and issues; culture, society and teacher eduation; learning and cognition; preservice education; inservice education; teacher education for implementing curriculum materials; practical and vicarious experiences; research.

Keywords: teacher education; inservice teacher education; preservice teacher education; educational quality - educational relevance; educational psychology; curriculum guides; teaching materials; teaching strategies; curriculum research; teacher education curriculum; Israel.

ISBN: 0-86689-022-x.

00228 - **Relative effects of a history/philosophy of science course on student teachers' performance on two models of science.** Ogunniyi, M.B. Carfax Publishing, Oxford, UK, 1983. p. 193-199. (Research in science and technology education; I, 2) (eng).

This study found that a course on the history and philosophy of science enhanced student teachers' understanding of science. It should follow that the views of science held by their own students should also be enhanced.

Keywords: teacher education curriculum; science philosophy; history of science; student teachers; Nigeria - teacher effectiveness; motivation; Africa.

00229 - **Results of a 50-state survey of initiatives in science, mathematics and computer education.** Armstrong, Jane M. Washington, National Science Board Commission on Precollege Education in Mathematics, Science and Technology, 1983. p. 141-203. (Educating Americans for the 21st century) (eng). // USA National Science Board. Commission on Precollege Education in Mathematics, Science and Technology

Provides outlines of innovations (responses to educational challenges) across the nation. There are ideas here for other policy makers.

Keywords: curriculum; educational innovations; educational policy; USA - mathematics education; computer science education.

00230 - **A Revised and intensified science and technology curriculum grades K-12 urgently needed for our future.** Lomon, Earle L. Washington, National Science Board Commission on Precollege Education in Mathematics, Science and Technology, 1983. p. 25-58. (Educating Americans for the 21st century) (eng). // USA National Science Board. Commission on Precollege Education in Mathematics, Science and Technology // Conference on Goals for Science and Technology Education Grades K-12, Washington, 1983

The conference identified lacks in science and technology in the United States and, as leading causes, deficiencies in precollege science and technology education. Recommendations are made.

Keywords: primary school curriculum; secondary school curriculum: mathematics education; USA - educational reform; curriculum development.

00231 - **Science and technology education and national development.** Morris, Robert W. Paris, Unesco, 1983. 197 p. (eng; also in ara, spa). // Unesco

A number of chapters in this book discuss in broad terms developments and trends in science education, including programmes in integrated science education and non-formal education. Wider issues include professional associations, various levels of education and international cooperation.

Keywords: education and development; educational trends; educational cooperation - nonformal education; professional associations; teacher associations.

// Vienna Programme of Action on Science and Technology for Development

ISBN: 92-3-102144-3.

00232 - **Science education 11-18.** James, E.O. Hatfield, UK, ASE, 1983. p. 18-19. (Education in science; 102) (eng). // Association for Science Education (UK)

This article picks out highlights from a report published by the Royal Society. It is of interest to policy makers who will not be reading the full report.

Keywords: secondary education; educational policy; core curriculum; UK.
// Royal Society (UK) // "Science Education 11-18" (UK)

00233 - **Science education through personal language use: an integrated approach in a primary school.** Carre, Clive G.; Howitt, Bill. Oxford, UK, Carfax Publishing, 1983. p. 243-254. (Educational review; XXXV, 3) (eng).

Suggests a programme which integrates the learning pupils are invited to do and the language they are using to do it. Some experiences are provided.

Keywords: primary school students; interdisciplinary approach; classroom techniques; learning processes.

00234 - **Science in a social context.** Solomon, Joan. Hatfield, UK, ASE, 1983. p. 33-34. (Education in science; 101) (eng). // Association for Science Education (UK)

This is an outline and rationale of the new SISCON course recently developed for new sixth forms.

Keywords: upper secondary education; sixth forms; teaching materials; UK.
// "Science in a Social Context" (UK)

00235 - **Science in primary schools: an HMI discussion paper.** Smith, C. Hatfield, UK, ASE, 1983. p. 23-25. (Education in science; 102) (eng). // Association for Science Education (UK)

A digest of a publication (by Her Majesty's Inspectors) said to be perhaps idealistic but containing much food for thought.

Keywords: primary school curriculum; UK.

00236 - **Science in schools.** London, ASE, 1983. p. 139-140. (Physics bulletin; XXXIV, 4) (eng). // Institute of Physics (UK)

This is a brief account of a report published by the Royal Society. Referring to British education, the recommendations include science for all to 16+, covering the three main branches. Some 20% of the curriculum time should be spent on science, at least in the fourth and fifth secondary years. Many children do not enjoy their science lessons, and a central aim in future enquiries should be to find out why this is so.

Keywords: core curriculum; general education; student attitudes; UK - interest (learning); curriculum research; research priorities; motivation.
// Royal Society (UK)

00237 - **Science teaching and the syllabus.** Perris, Lyall. New Zealand, New Zealand Science Teachers' Association, 1983. p. 19-21. (N Z science teacher; 38) (eng). // New Zealand Science Teachers' Association

Briefly explores the nature of science, which is often not understood by teachers. Goes on to refer to studies on children's science vs scientists' science. Finally attempts to dispel ideas that a national syllabus inhibits teachers from reflecting science in their classrooms. An alternative view is presented by Rob Julian in the next article "An alternative view of science teaching and the curiculum", p. 22-23.

Keywords: secondary school curriculum; science philosophy; teacher responsibility; educational policy; New Zealand.
// Learning in Science (New Zealand)

00238 - **Secondary Science Curriculum Review: an alternative view.** Long, R.R. Hatfield, UK, ASE, 1983. p. 22-24. (Education in science; 103) (eng). // Association for Science Education (UK)

This teacher feels that recent proposals in Britain are unrealistic. He appears to hold the view that priority at this time should be given to the lower ranks of the ability range, and that integrating the sciences is impractical.

Keywords: ability grouping; low achievers; secondary school curriculum; UK - educational goals.
// Secondary Science Curriculum Review (UK)

00239 - **A Single system of examining at 16+.** Hatfield, UK, ASE, 1983. p. 11-12. (Education in science; 104) (eng). // Association for Science Education (UK)

Subtitled "A statement of the position of the ASE", this is a concise response to *drafts which have been prepared in Britain.*

Keywords: general education; examinations; upper secondary education; UK.

// General Certificate of Secondary Education (UK)

00240 - **Teaching science to the slow learner.** Smith, Veronica. Hatfield, UK, ASE, 1983. p. 138-140. (School science review; 230) (eng). // Association for Science Education (UK)

This teacher describes her experiences first of teaching an integrated science curriculum to a difficult class and then of "throwing away the book". Many successes are mentioned.

Keywords: ability grouping; slow learners; lower secondary education - motivation; teaching strategies; activity learning; UK.

00241 - **What would John Dewey say about science teaching today?** Vandervoort, F.S. Reston, Va., National Association of Biology Teachers, 1983. p. 38-41. (American biology teacher; XLV, 1) (eng). // National Association of Biology Teachers (USA)

Dewey left us with many ideas which should be applicable to science teaching today: (a) inquiry (b) knowledge by means of experience (c) education for citizenship. The writer claims that science curricula are still far from these ideals.

Keywords: educational aims; teaching methods - civic education; activity learning.

// Dewey, John

1984

00242 - **The Differential uptake of science in schools in England, Wales and Northern Ireland.** Driver, Rosalind; Head, Jennifer; Johnson, Sandra. London, Taylor and Francis, 1984. p. 19-29. (International journal of science education; VI, 1) (eng; abstr. in fre, ger).

The study had four purposes: (a) to present findings (b) to comment on the differences among the three areas (c) to note the changes since a survey by Her Majesty's Inspectors in the 70s and (d) to discuss the implications in the light of proposals that all pupils up to the age of 16 should follow a balanced science curriculum. It was found that a sizeable minority of schools, especially in Northern Ireland, do not offer all three sciences. Gender and ability biases were noted. General science was the usual course for pupils of low attainment. The paper contrasts the recommendations of various bodies on (for fourth and fifth forms) integrated science or combined courses versus separate but coordinated teaching of the three main sciences. The study also found only a small proportion of technology based courses.

Keywords: upper secondary education; core curriculum; teacher attitudes; comparative education; UK - sex discrimination; ability; slow learners.

// Assessment of Performance Unit (UK) // UK. Dept. of Education and Science // Royal Society (UK) // Secondary Science Curriculum Review (UK)

00243 - **An Experimental evaluation of the revised edition of the Nigerian Integrated Science Project**. Olarewaju, AdedayoO. Ibadan, Nigeria, STAN, 1984. p. 89-95. (Journal of the Science Teachers' Association of Nigeria; XXII, 2) (eng). // Science Teachers' Association of Nigeria

The study aimed to find out whether the presentation of instructional objectives before the lesson (as in the revised edition of the Project) would enhance achievement. The finding was that students performed significantly better on the Integrated Science Achievement Test if they were given the objectives in advance.

Keywords: lower secondary education; curriculum evaluation; classroom techniques; teaching strategies; academic achievement; Nigeria.

// Nigerian Integrated Science Project

00244 - **Integrated science: annual report.** Association of Science Teachers of Nigeria. Annual Conference, 25th, Ibadan, 1984. Ibadan, STAN, 1984. p. 189. (eng). // Science Teachers' Association of Nigeria

Reports on a national workshop, its aims, resolutions and propositions.

Keywords: lower secondary education; educational workshops; teacher associations; Nigeria.

00245 - **Integrated science at the senior secondary school: what prospects?** Jegede, Olugbemiro Johnson. Zaria, Ahmadu Bello University, 1984. 26 p. (eng). // Ahmadu Bello University // West African Examinations Council. Monthly Seminar, 1984

The paper reviews the background to integrated science in general and in Nigeria. It presents a variety of arguments for integrated science at the higher level, but also recognises countervailing forces. Implications include teacher education, physical facilities, testing and evaluation. Finally, a project is proposed.

Keywords: upper secondary education; Nigeria - teacher education; educational facilities; educational testing; student evaluation.

00246 - **Integrated science teaching and the need for radical change in schools even with limited resources at our disposal.** Odobunmi, Olagunju. Ibadan, STAN, 1984. p. 147-149. (eng). // Science Teachers' Association of Nigeria // Science Teachers' Association of Nigeria. Annual Conference, 25th, Lagos, 1984

Examines the meaning of integrated science. A brief background to science curriculum development leads into the Nigerian Integrated Science Project of 1970 and the strategies visualized by the Science Teachers' Association of Nigeria. Classroom observation studies indicate that these strategies were not realized in practice. The author advocates retraining and proposes themes for workshops for integrated science teachers and inspectors.

Keywords: secondary school curriculum; curriculum development; inservice teacher education; educational strategies; Nigeria - refresher courses; educational workshops; educational projects; project evaluation; evaluation of education.

// Nigerian Integrated Science Project

00247 - **A Piaget-based integrated math and science program.** Kolodiy, George Oleh. Washington, NSTA, 1984. p. 297-299. (Journal of college science teaching; 13, 4) (eng). // National Science Teachers Association (USA)

Describes a lecture/laboratory course that stresses physical experience and peer interaction in an inquiry-discovery format. The course is required of all incoming freshmen who are non-science majors. Highlights of such course strategies as performing experiments that demonstrate physical properties before introducing mathematical concepts or physical laws are discussed.

Keywords: mathematics education; higher education; general education; USA - activity learning; experiments (lessons).

00248 - **Primary and secondary school science.** New York, UNIPUB, 1984. p. 1-82. (Educational documentation and information; 231) (eng).

This 344-item annotated bibliography presents overview of science teaching in the following categories: science education; primary school science; integrated science teaching; teaching of biology, chemistry, physics, earth/space science; laboratory work; computer technology; out-of-school science; science and society; science education at international, regional, national levels; references and research. The index lists authors and editors.

Keywords: primary education; secondary education; bibliographies - educational equipment; lower secondary education; curriculum development; school laboratories; teaching methods; out of school education; experiments (lessons); computer applications.

00249 - **Reasoning ability of preservice primary teachers: implications for science teaching.** Tobin, Kenneth; Garnett, Patrick J. Melbourne, Australia, ACER, 1984. p. 89-98. (Australian journal of education; XXVIII, 1) (eng). // Australian Council for Educational Research

Results suggest that students with high formal reasoning ability are best equipped to teach primary science. They can utilize formal modes of thinking during science lessons and are more likely to have studied physical science subjects in Year 12 at school and to have engaged in the science elective studies in the preservice teacher education programme.

Keywords: primary teacher education; student teachers; educational psychology; teacher effectiveness; preservice teacher education; Australia - classroom techniques; elective courses; ability; reasoning.

00250 - **(Report).** Conference and Workshop on Resources for Science Teaching, Valsayn, Trinidad and Tobago, 1984. St. Augustine, Trinidad and Tobago, ASETT, 1984. p. 1-6. (Journal of education in science for Trinidad and Tobago; XII, 1) (eng). // Association for Science Education of Trinidad and Tobago // Conference and Workshop on Resources for Science Teaching, Valsayn, Trinidad and Tobago, 1984

The occasion of ASETT's tenth anniversary was associated with the Committee on Science and Technology in Developing Countries and the International Council of Associations for Science Education. Short reports of the various discussion groups are provided.

Keywords: teacher associations; teaching materials; Trinidad and Tobago - examinations.

00251 - **Science and technology education.** Legg, Keith. Hong Kong, HKASME, 1984. p. 1-6. (Journal of the Hong Kong Association for Science and Mathematics Education; XII, 2) (eng). // Hong Kong Association for Science and Mathematics Education

An address presented in the form of "eleven lessons" for tertiary education. The speaker is Director of the Hong Kong Polytechnic.

Keywords: higher education; university curriculum; teaching methods; educational aims.

00252 - **Science education in Asia and the Pacific.** Bangkok, ROEAP, 1984. p. 1-498. (Bulletin for the Unesco Regional Office for Education in Asia and the Pacific; 25) (eng). // Unesco Regional Office for Education in Asia and the Pacific (Thailand)

Section 1 is an introduction to science and technology education and summarizes practice within the region. At primary level science is a core subject in all countries though approaches vary and severe constraints are faced. At lower secondary level, science is commonly, though not always integrated. At upper secondary level science is more often taught as separate subjects and is optional in most, though not all countries. Generally, secondary science education is academic, elitist and subject oriented. There are notes on equipment and educational technology, science teacher training and non-formal programmes. Section 2 is a country by country account of the state of science education and its development and provides voluminous information on practice in each of the 24 countries. Section 3 consists of some papers describing the development of programmes of science for all. Sections 4 is a 51 page annotated bibliography.

Keywords: science education; primary school curriculum; secondary school curriculum; out of school education; Asia and the Pacific - core curriculum; elective courses; educational technology; science popularization; educational trends; nonformal education; curriculum development; bibliographies; Afghanistan; Australia; Bangladesh; China; India; Indonesia; Iran (Islamic Republic); Japan; Lao PDR; Malaysia; Mongolia; Nepal; New Zealand; Pakistan; Papua New Guinea; Philippines; Korea R; Viet Nam SR; Sri Lanka; Thailand; Turkey; USSR.

00253 - **Science education in Canadian schools; summary of Background Study 52.** Orpwood, Graham; Souque, Jean Pascal. Ottawa, Science Council of Canada, 1984. 26 p. (eng; also in fre). // Science Council of Canada

The summary refers to a study conducted between 1980 and 1983 resulting from criticism about the way science was being taught in elementary and secondary schools. Science education seemed to lack Canadian content and personal, social and national relevance. Specific problems were identified, and four major research projects undertaken. On the basis of these, issues for deliberation are suggested.

Keywords: educational relevance; primary school curriculum; secondary school curriculum; Canada - teaching standards; social needs; educational policy; curriculum development; education and culture; curriculum research.

00254 - **Science for all: implication for higher education.** Blin-Stoyle, Roger J. London, IoP, 1984. p. 168-172. (Physics education; XIX, 4) (eng). // Institute of Physics (UK)

A university professor of theoretical physics and Fellow of the Royal Society has no doubts that secondary science education should move as quickly as possible towards a broad and balanced programme for all up to 16+. The article considers the pressures due to higher education and believes that a core stream could be identified that would flow through 11-16 and into A-level studies. Higher education should then improve its selection system in order to remove the pressure for high A-level performance, thus broadening *school education.*

Keywords: secondary school curriculum; core curriculum; science and technology; higher education; UK - general education; ability grouping; specialization; student selection.

00255 - **Science for every student: educating Canadians for tomorrow's world.** Ottawa, Science Council of Canada, 1984. 11 p. (eng). // Science Council of Canada

This follows from Background Study 52 on science education in Canadian schools (summary by Orpwood and Souque). The present document analyses the study's findings and presents recommendations for bringing about essential renewal in science education.

Keywords: curriculum evaluation; educational innovations; general education; Canada - educational needs; educational projects; curriculum development.

00256 - **Science subject-choice and students' attitudes to science.** Burns, Janet. Wellington, New Zealand Science Teachers' Association, 1984. p. 7-12. (N Z science teacher; 40) (eng). // New Zealand Science Teachers' Association

Provides analyses of data which show, "inter alia", increasing choice of "science" in secondary school but decreasing choice of individual sciences, especially the physical sciences. There are comparisons by gender, by ethnic origin and by rural/urban areas. The analyses about attitudes include ability and the type of science.

Keywords: elective courses; student attitudes; physical sciences; New Zealand.

00257 - **Submission to the Minister of Education by the New Zealand Institute of Physics (concerning the review of the core curriculum for schools).** Wellington, New Zealand Science Teachers' Association, 1984. p. 19-20. (N Z science teacher; 40) (eng). // New Zealand Science Teachers' Association

For the intermediate level (11-12-year-old) the submission urges the provision of science specialists. This level of schooling is considered the weak link in the chain, and fails to realise children's full potential.

Keywords: lower secondary education; core curriculum; teacher qualifications; specialists; New Zealand - teacher effectiveness; educational opportunities.

// New Zealand Core Curriculum Review

00258 - **Teaching the right stuff: where it's happening today.** Mrachek, Len. Arlington, Va., American Vocational Association, 1984. p. 30-39. (Vocational education journal; LIX, 2) (eng). // American Vocational Association

These five articles discuss the improvement of vocational education programs though the infusion of mathematics and science skills. They include an auto mecnanics curriculum; an 11th-grade industrial arts program (orientation, electricity, plumbing); a combination automotive services-small business program; and two programs at one school - engineering processes and materials and electronics technology.

Keywords: vocational school curriculum; industrial arts; technical and vocational education; curriculum development; USA.

00259 - **Towards a social slant in science teaching.** Seecharan, Premlal. St. Augustine, Trinidad and Tobago, ASETT, 1984. p. 1-5. (Journal of education in science for Trinidad and Tobago; XII, 1) (eng). // Association for Science Education of Trinidad and Tobago

The article begins with a distinction between science and technology, but insists that technological development is a powerful reason for teaching science in schools, indeed throughout the school curriculum. The writer goes on to provide sets of intrinsic and extrinsic reasons for science for all. He identifies major problems of science teaching in Trinidad and Tobago, essentially concerned with teachers' attitudes and lack of professional training. Recommendations include integration of science and integration of curricula. In his physics classes this teacher has successfully used exercises and discussions stimulated by newspaper clippings on science in a social context.

Keywords: science and technology; technological change; educational relevance; upper secondary education; core curriculum - education and development; teacher attitudes; teacher education; teaching materials; teaching method innovations; interdisciplinary approach; physics education; Trinidad and Tobago.

00260 - **Towards integrated science teaching consistent with the nature of science and humanistic precepts.** Igwebuike, Thomas B. Ibadan, Nigeria, STAN, 1984. p. 49-58. (Journal of the Science Teachers' Association of Nigeria; XXII, 2) (eng). // Science Teachers' Association of Nigeria

Science teachers and educators appear not to have grasped the philosophical basis for integrating science. Accordingly, this paper attempts to provide a conceptual analysis of the nature of science and a humanistic approach to education. This requires the development of scientific literacy through the use of processes of science while teaching, and reference to the nature of the child.

Keywords: science philosophy; humanism - scientific literacy; teaching strategies; child development.

1985

00261 - **The Development of primary science education in Trinidad and Tobago.** Fraser-Abder, Pamela. St. Augustine, Trinidad and Tobago, University of the West Indies, 1985. p. 55-67. (Caribbean curriculum; 1) (eng). // University of the West Indies (Trinidad and Tobago)

This describes the effort to ensure the teaching of science in primary schools, a collaborative enterprise of the University and Ministry of Education. The resulting programme is SAPATT (Science: a Process Approach for Trinidad and Tobago), undertaken in 1977 and involving the teachers in its development.

Keywords: primary school curriculum; curriculum development; educational coordination; Trinidad and Tobago.

// Science: a Process Approach for Trinidad and Tobago

00262 - **Engineers for rural well-being.** Arbab, Farzam. Ottawa, IDRC, 1985. p. 132-143. (Science, education and society: perspectives from India and South East Asia) (eng). // International Development Research Centre (Canada) // Seminar on Education, Science Policy, Research and Action, New Delhi, 1984

Outlines FUNDAEC of Colombia, an institution somewhat misleadingly called a rural university. One of the central issues is integration of curricula, though constraints have been recognised.

Keywords: engineering education; rural development; education and development; higher education; Colombia - university curriculum.

// Fundación para la Aplicación y Enseñanza de las Ciencias (Colombia)

00263 - **An Experimental programme in integrated natural science education in Bulgaria.** Golovinski, Evgeny; Lazarov, Dobri. Paris, Unesco, 1985. p. 593-596. (Prospects: quarterly review of education; XV, 4) (eng; also in fre, spa). // Unesco

A problem is how to introduce the latest information from the interface between sciences into the existing curricula of primary and secondary schools. Here is a preliminary report on an integrated subject called "nature study" for 10-12 year olds in 29 schools. Presents rationale and lists "integral foci". An independent learning strategy is used. Students reacted favourably but teachers had some difficulties, being specialists themselves.

Keywords: primary school curriculum; lower secondary education; classroom techniques; Bulgaria - student attitudes; teacher attitudes; teaching methods; learning methods; independent learning.

// Nature Study (Bulgaria)

00264 - **A Framework for curriculum development.** Hatfield, UK, ASE, 1985. p. 12-22. (Planning for science in the curriculum) (eng). // Association for Science Education (UK)

This chapter gives a structure for innovation and could prove useful to teachers.

Keywords: curriculum development; educational aims; teaching method innovations; skill development; teaching skills.

00265 - **The Home as a context for the science curriculum.** Browne, Claudia. St. Augustine, Trinidad and Tobago, ASETT, 1985. p. 14-16. (Journal of education in science for Trinidad and Tobago; XII, 3) (eng). // Association for Science Education of Trinidad and

Tobago

A home economics educator suggests that a home context for conventional scientific concepts is one of the needs of children doing no science after lower secondary school, and is also likely to increase motivation. For science teachers she identifies topics and concepts related to nutrition (and economics), food preservation, food preparation, textile and clothing cleaning. The writer draws attention to trends in the direction of social relevance and is concerned that homemakers should have a scientific background for their practices and decision-making in an unpredictable future.

Keywords: home economics education; lower secondary education; educational relevance; general education; motivation; nutrition education; Caribbean.

00266 - **Influences on the practice of science curriculum innovation in the Caribbean, pt. 1: socio-historical.** King, Winston K. St. Augustine, Trinidad and Tobago, ASETT, 1985. p. 1-7. (Journal of education in science for Trinidad and Tobago; XII, 2) (eng). // Association for Science Education of Trinidad and Tobago

An attempt is made to identify the forces contributing to change in the status of science in the school curriculum from the 1960s. These include the relinquishing of colonial ties, the establishment of the university, economic pressures and social movements, advances in science and technology, and curriculum development elsewhere.

Keywords: educational innovations; social change; educational history; educational aims; Caribbean - technological change; education and culture.

00267 - **Influences on the practice of science curriculum innovation in the Caribbean, pt. 2: contextual factors.** King, Winston K. St. Augustine, Trinidad and Tobago, ASETT, 1985. p. 7-13. (Journal of education in science for Trinidad and Tobago; XII, 3) (eng). // Association for Science Education of Trinidad and Tobago

The discussion is set against data from a case study of a primary science innovation in a Caribbean country. Implementation of innovations is influenced by the nature of the subject matter, features of the curriculum, school climate and facilities, and communication of information.

Keywords: teaching method innovations; teacher effectiveness; Caribbean - educational environment; educational facilities.

// Science Teacher Observation Schedule (UK)

00268 - **Influences on the practice of science curriculum innovation in the Caribbean, pt. 3: internal factors.** King, Winston K. St. Augustine, Trinidad and Tobago, ASETT, 1985. p. 1-5. (Journal of education in science for Trinidad and Tobago; XIII, 1) (eng). // Association for Science Education of Trinidad and Tobago

The internal factors refer to those which impinge most directly on the teacher, including training, teacher's perception of aims, teaching style and age and ability of pupils. The author closes by providing a diagram of the influences on the practice of science curriculum innovation. Recommendations are made.

Keywords: teaching method innovations; teacher education; teacher effectiveness - curriculum development; Caribbean.

00269 - **Integrated science as a preparation for 'A' level physics, chemistry and biology.** Chamberlain, Peter J. Oxford, UK, Carfax Publishing, 1985. p. 153-158. (Research in science and technological education; III, 2) (eng).

The author compares performance in A-level science examinations of students in a tertiary college who had taken SCISP with students who had studied the separate sciences to O-level. Performance was found to be not significantly different between the two groups though SCISP students must have spent considerably less time per science subject in their 11-16 schools. Thus there is no evidence to suggest that SCISP inhibited subsequent progress.

Keywords: academic achievement; sixth forms; specialization; upper secondary education; examinations; UK.

// Schools Council Integrated Science Project (UK)

00270 - **Integrated science teachers' perceived needs for organizational skills relevant to out of school scientific activities.** Onocha, C.O.; Okpala, N.P. Hong Kong, HKASME, 1985. p. 173-181. (Journal of the Hong Kong Association for Science and Mathematics

Education; XII, 2) (eng). // Hong Kong Association for Science and Mathematics Education

A study identified the needs of teachers. Regular workshops and inservice courses are recommended since science methods courses do not adequately equip teachers for such activities.

Keywords: out of school education; inservice teacher education; educational workshops; Nigeria.

00271 - **Organising the teaching of science**. Hatfield, UK, ASE, 1985. p. 23-43. (Planning for science in the curriculum) (eng). // Association for Science Education (UK)

The chapter illustrates how some schools have attempted to implement the two major themes of the Association's publication "Education through science": (a) science for all (b) general education through science. Of special interest are different timetable frameworks for integrated science throughout; core science and other science options; core science and other extension courses; core science up to 14 with choice of sciences in years 4-5; physical and biological science for all; coordinated three subjects for all; interdisciplinary courses (science and other subjects).

Keywords: physics education; biology education; curriculum development; core curriculum; UK - interdisciplinary approach; elective courses.

00272 - **'People's science and development theory**. Kumar, Krishna. Ottawa, IDRC, 1985. p. 70-78. (Science, education and society: perspectives from India and South East Asia) (eng). // International Development Research Centre (Canada)

The people's science movement has among its objectives the development of scientific literacy among the masses, the re-assessment of "Western" science and technology and challenging the forces of superstition.

Keywords: science popularization; science and development; scientific literacy; India - education and development; nonformal education.

00273 - **Planning for change**. Hatfield, UK, ASE, 1985. p. 1-11. (Planning for science in the curriculum) (eng). // Association for Science Education (UK)

This chapter advocates, for primary schools, science integrated with the total curriculum. For age 14, the "option system" is deplored, and a broad and balanced science education for all is advocated. The bulk of the chapter is concerned with the practicalities of introducing change.

Keywords: primary school curriculum; secondary school curriculum; educational innovations - curriculum development; elective courses; core curriculum; UK.

00274 - **Planning for science in the curriculum**. Hatfield, UK, ASE, 1985. 65 p. (eng). // Association for Science Education (UK). Working Party on Curriculum Models for Science 5-16

Follows the ASE's "Alternatives for science education" (1979) and "Education through science" (1981), the latter being a policy statement. This report suggests how policy could be turned into practice.

Keywords: primary school curriculum; secondary school curriculum; curriculum development; UK - teaching strategies; educational innovations.

ISBN: 0-86357-034-8.

00275 - **Primary education science and technology: a different PEST in the classroom**. Bellett, D.J. Hatfield, UK, ASE, 1985. p. 39-40. (Education in science; 111) (eng). // Association for Science Education (UK)

An account of an in-school approach involving the cooperation of an engineer and using a dramatic approach (with the children "marooned on a desert island"). Problems solved included making a fire, building a dam, making hunting and fishing equipment, collecting rainwater, collecting salt from sea water, making waterproof shelters, irrigation and, finally, buoyancy for the escape.

Keywords: technology; primary school curriculum; teaching method innovations; classroom techniques; educational games.

00276 - **Progression, continuity and community**. Hatfield, UK, ASE, 1985. p. 44-54. (Planning for science in the curriculum) (eng). // Association for Science Education (UK)

Describes cooperation between primary and secondary schools with local communities and employers.

Keywords: primary schools; secondary schools; school community relationship; industry and education; UK.

00277 - **Pupils' topic preference in integrated science in selected secondary schools in the Ilorin LGA of Kwara State.** Ihebuzor, Noel A.; Adelaiye, Esther O. Ibadan, Nigeria, STAN, 1985. p. 131-137. (Journal of the Science Teachers' Association of Nigeria; XXIII, 1&2) (eng). // Science Teachers' Association of Nigeria

A study on a.sample of 300 Form 3 pupils found that pupils tend to prefer topics that are largely biology-related at the expense of either chemistry or physics related topics. Reasons are discussed and recommendations are made.

Keywords: interest (learning); lower secondary education; student attitudes - life sciences; physical sciences; Nigeria.

00278 - **Recent trends and issues in science education in Southeast Asia.** Nielsen, Dean. Ottawa, IDRC, 1985. p. 54-68. (Science, education and society: perspectives from India and South East Asia) (eng). // International Development Research Centre (Canada) // Seminar on Education, Science Policy, Research and Action, New Delhi, 1984

Focuses chiefly on primary and secondary education. Covers curriculum reform, curriculum development, equipment, teacher education, nonformal science education and regional collaboration. Notes numerous examples of integration in Southeast Asia and a variety of approaches to teacher education and teacher support.

Keywords: primary education; secondary education; educational trends; South East Asia - curriculum development; educational equipment; teacher education; nonformal education; regional cooperation.

00279 - **Science, education and society: perspectives from India and South East Asia.** King, Kenneth. Ottawa, IDRC, 1985. 216 p. (eng). // International Development Research Centre (Canada) // Seminar on Education, Science Policy, Research and Action, New Delhi, 1984

Because certain IDRC activities are explicitly interdisciplinary, the Centre has been exploring possible research connections among science, technology, education, employment, manpower and training in three regions of the developing world. The resulting programme is TEED: Tecnnology, Education and Employment for Development. This volume is fundamentally concerned with science above values and science without values. It questions mainstream science, whether in school or in society, and raises alternatives.

Keywords: science and development; education and development; interdisciplinary approach; India; South East Asia - science policy; education and employment; educational relevance.

// "Technology, Education and Employment for Development"

00280 - **Science education in Nigerian secondary schools: a reappraisal.** Banu, D.P. Ibanan, Nigeria, STAN, 1985. p. 39-44. (Journal of the Science Teachers' Association of Nigeria; XXIII, 1&2) (eng). // Science Teachers' Association of Nigeria

Deplores the absence of social aspects of science, and cites studies which show that the goal dominating the curriculum is the preparation of candidates to pass WASC or GCE. Those studies also showed that the examination questions were very limited. All this is contrary to the goals expressed for Nigerian education. Also absent is attention to personal needs and career awareness in science.

Keywords: upper secondary education; educational goals; educational relevance; examinations; educational needs; education and employment; Nigeria.

00281 - **Science for all: a reflective essay.** Fensham, Peter J. London, Taylor and Francis, 1985. p. 415-435. (Journal of curriculum studies; XVII, 4) (eng).

As "science for all" is a contemporary slogan around the world in the 80s, the author analysises what was done in the 60s and 70s. He believes that there is growing consensus in a number of countries concerning present day science education in schools to the effect that (a) there are much better curricula for the group (approximately 20%) from which future scientists and science related professionals will be drawn (b) we have not achieved an effective science education for the other 80% who will not continue with any *formal education in science after they leave school. The adequacy of new curricula in the next decade will depend very considerably on how clearly we can read the realities of the earlier attempts and the realities of the current day.*

Keywords: core curriculum; educational trends; ability grouping; evaluation of education - education and employment; scientific literacy; educational relevance; educational goals.

00282 - **Some CXC concepts**. Glasgow, Joyce. St. Augustine, Trinidad and Tobago, ASETT, 1985. p. 7-12. (Journal of education in science for Trinidad and Tobago; XII, 2) (eng). // Association for Science Education of Trinidad and Tobago

This is a tabulation of the concepts reflected in the Caribbean Examinations Council syllabuses for biology, chemistry, integrated science (single award) and physics. The writer aims to identify some of those concepts a Caribbean child, on leaving secondary school, is supposed to have grasped. The list should also prove useful in (a) judging how balanced a particular course of study would be (b) facilitating cooperation among science teachers and (c) acting as a starting point for similar analyses elsewhere.

Keywords: concepts; scientific literacy; upper secondary education; general education; biology education; chemistry education; physics education; Caribbean.

// Caribbean Examinations Council

00283 - **A Study of teaching and learning processes in integrated science classrooms.** Hacker, R.G.; Rowe, M.J. London, Taylor and Francis, 1985. p. 173-180. (International journal of science education; VII, 2) (eng; abstr. in fre, ger).

This report of an empirical study at the lower secondary level focuses on the specialist science teacher with an integrated curriculum and uses the Science Lesson Analysis System for data collection. Informational approaches were found to be more likely when the teacher was outside his specialist discipline, the change being at the expense of problem-solving or inquiry. Subjects had all been trained in teaching an integrated science curriculum and had spent at least six years teaching it. Findings cast doubt on the Nuffield Combined Science recommendation that unification would be best achieved by a single teacher. Science teachers do not share curriculum developers' enthusiasm for teaching outside specialist areas.

Keywords: specialists; teacher attitudes; teacher effectiveness; lower secondary education; teaching methods; UK - teacher education; problem solving; educational research; learning processes.

// Nuffield Combined Science (UK) // Science Lesson Analysis System (UK)

00284 - **Teaching science, mathematics, technical and vocational education in an integrated way.** Bajpai, A.C. London, CASME, 1985. p. 1-13. (Commonwealth Association of Science, Technology and Mathematics Educators journal; V, 2) (eng). // Commonwealth Association of Science, Technology and Mathematics Educators

Shows how a topic "measurement" as a coordinating theme could be prepared and implemented. Physics, chemistry, biology and technical and vocational education are identified. Objectives are established, each being accompanied by supporting strategies. A student module and teacher's notes are given to illustrate.

Keywords: interdisciplinary approach; technical and vocational education; curriculum development; biology education; chemistry education; learning modules; classroom techniques; teaching strategies.

00285 - **Technology and science: technology and the Secondary Science Curriculum Review.** Ditchfield, Christine. Nottingham, UK, National Centre for School Technology, Trent Polytechnic, 1985. p. 12-14. (School technology; XVIII, 3) (eng). // Trent Polytechnic (UK). National Centre for School Technology

Explains the SSCR of the Association for Science Education, and describes what is being done about technology in the Review.

Keywords: technology; general technical education; secondary school curriculum; educational trends; educational innovations; UK - teacher associations.

// Secondary Science Curriculum Review (UK)

00286 - **Trends in science and technology education.** Holbrook, J.B. Hong Kong, HKASME, 1985. p. 149-162. (Journal of the Hong Kong Association for Science and Mathematics Education; XIII, 2) (eng). // Hong Kong Association for Science and Mathematics Education

Contrasts the aims from the post-Sputnik era with the present goal of science for all, with shifts from science teaching to science learning, from teacher-centered instruction, and towards more process and problem-solving. Characteristics of scientific literacy are cited and associated with technology. Aims are characterised as factual, conceptual and the acquisition of values. A distinction is made among the emphases of different groups. There is a consideration of implications for teacher training and retraining and science teachers' associations.

Keywords: educational aims; scientific literacy; educational trends - teacher education; teacher associations; pressure groups; Canada; USA.

// Science Council of Canada // National Science Teachers Association (USA) // Science and technology education and future human needs conference, Bangalore, India, 1985

00287 - **The Whole curriculum perspective.** Hatfield, UK, ASE, 1985. p. 55-61. (Planning for science in the curriculum) (eng). // Association for Science Education (UK)

It is stressed that schools need people who are coordinators across the curriculum in order to link scientific concepts, contexts and processes. There are illustrations of ways of achieving this.

Keywords: curriculum development; educational coordination; teacher responsibility; articulation.

1986

00288 - **The Activities of pioneer centres in the USSR.** Grekova, Olga. Paris, Unesco, 1986. p. 155-162. (Innovations in science and technology education; 1) (eng). // Unesco

Out of school institutions are an integral part of the education system and their work is based on the general principles of communist upbringing. The functions are described and illustrated.

Keywords: out of school education; extracurricular activities; youth organizations; USSR.

// Pioneer Centres (USSR)

00289 - **Agriculture in history of science and technology curricula.** De Beaver, Donald. Bethlehem, Pa., STS Program, Lehigh University, 1986. p. 1-4. (Science, technology and society; 57) (eng). // Lehigh University (USA). Science, Technology and Society Program

Points out agriculture's central position in the human economy and advocates its placement in liberal education. Provides a list of topics highlighting agriculture in the history of science and technology curriculum. Discusses the potential for using agriculture material in undergraduate science courses.

Keywords: agricultural engineering; agricultural education; higher education; general education; USA.

00290 - **Application of calculators and computers in science and mathematics education.** Shumway, Richard J. Paris, Unesco, 1986. p. 117-136. (Innovations in science and technology education; 1) (eng). // Unesco

Future-oriented as costs fall, the author assumes that computers and calculators will be available to children. He reviews research done on their use in the classroom. He is clear that responsibility is to help the youth of today learn to use these powerful tools.

Keywords: mathematics education; computer assisted instruction; calculating machines; educational technology - teaching strategies; curriculum development; computer languages; computer programming.

00291 - **The Case for GCSE science: a view from the classroom.** Best, P.H.; Drake, J. Hatfield, UK, ASE, 1986. p. 803-806. (School science review; 241) (eng). // Association for Science Education (UK)

The authors detect confusion in relation to the forthcoming National Curriculum. They propose a compromise, which is essentially a common core of integrated science in Years 3 *and 4 and a choice of four options from ten in Year 5.*

Keywords: core curriculum; secondary school curriculum; educational policy; examination boards; UK - specialization; elective courses.

// UK National Curriculum

00292 - **Cognitive acceleration: review and prospects.** Adey, Philip S. St. Augustine, Trinidad and Tobago, University of the West Indies, 1986. p. 84-99. (Science education and research in Latin America and the Caribbean) (eng). // University of the West Indies (Trinidad and Tobago) // Meeting on Science Education Research in Latin America and the Caribbean, Port-of-Spain, 1980

In the face of findings that many curricula make excessive demands on children, an attempt is being made to undertake cognitive acceleration: raising pupils levels of thinking. The paper reviews the literature on cognitive acceleration.

Keywords: mental development; cognition; learning processes; lower secondary education; teaching method innovations; literature reviews; UK - reasoning.

// Cognitive Acceleration through Science Education (UK)

00293 - **Ethics and responsibility in science education.** Frazer, Malcom J.; Kornhauser, Alexandra. Oxford, UK, Pergamon Press, 1986. 264 p. (Science and technology education and future human needs; 2) (eng). // International Council of Scientific Unions // Conference on Science and Technology Education and Future Human Needs, Bangalore, India, 1985

This volume aims to stimulate an awareness of the ethical and social dimensions in science education. Intrinsic and extrinsic problems are presented. Information is given on the efforts being made in education to deal with ethical and social problems. A range of contributors is represented.

Keywords: ethics of science; sociology of science; social responsibility - primary school curriculum; secondary school curriculum; educational relevance.

ISBN: 0-08-033912-3.

00294 - **Health education and science education: changing roles, common goals?** Garrard, Jan. Leeds, UK, Leeds University Centre for Studies in Science Education, 1986. p. 1-26. (Studies in science education; 13) (eng). // Leeds University (UK). Centre for Studies in Science Education

Suggests a sharing of expertise between science education and health education - science education in search of relevance, health education in search of a place in the curriculum. The article aims to provide science educators with some of the broader social science based background of health and health education.

Keywords: health education; educational relevance; educational coordination.

00295 - **Innovators' dilemmas: recontextualizing science and technology education.** Layton, David. Paris, Unesco, 1986. p. 9-28. (Innovations in science and technology education; 1) (eng). // Unesco

Takes an overview of science education and reform movements in the last 30 years and changes in direction in the 1980s. As examples, mention is made of some major policy statements. There appears to be a conflict between curricula for trained scientists and for educated citizenry. Measures to resolve this dilemma are suggested. Only recently has technology education begun to contribute to general education, and another dilemma is its relationship to science education. The cultural context of science and technology education is now a matter for attention. The chapter closes by a realistic discussion of what actually happens in curriculum change.

Keywords: educational innovations; educational trends; education and development; educational reform; curriculum development - education and culture; general technical education; scientific literacy.

// "Science for Every Student" (Canada)

00296 - **An integrated college freshman natural science curriculum.** Garafalo, Alfred R.; LoPresti, Vincent C. New York, American Chemical Society, 1986. p. 854-858. (Journal of chemical education; 63, 10) (eng). // American Chemical Society

Describes an integrated freshman course sequence which combines biology and chemistry and uses the process of energy flow as a unifying concept. Provides a description of the *three-quarters course sequence, along with lists of topics covered in both disciplines. Includes a rationale for developing such interdisciplinary courses.*

Keywords: biology education; chemistry education; higher education; interdisciplinary approach; USA - teaching methods; university curriculum.

// Massachusetts College of Pharmacy Allied Health Science (USA)

00297 - **Integrated or co-ordinated science?** Black, PaulJ. Hatfield, UK, ASE, 1986. p. 669-681. (School science review; 241) (eng). // Association for Science Education (UK)

In his Presidential, Address the author discusses the articulation of the three separate sciences at secondary level up to the age of 16. He considers the nature of science, five principles of curriculum design and the needs and entitlement of pupils. He makes practical proposals in the light of recent change in national policy. He advocates a single subject with a single title - Science, or Sciences - and points out the need to attend to public esteem.

Keywords: secondary school curriculum; educational coordination; articulation; examinations; UK - specialization; sociology of science; science philosophy; curriculum development; educational aims; educational needs.

00298 - **Integrating science/mathematics with language arts: gifted child programme suited for all**. Cross, Roger. Hatfield, UK, ASE, 1986. p. 808-812. (School science review; 241) (eng). // Association for Science Education (UK)

As well as trends towards science, technology and society, more attention to the affective domain is needed. The project described here attempts to integrate science, literature and mathematics with gifted lower secondary pupils to provide a more humanistic approach towards mathematics and science.

Keywords: gifted students; mathematics education; humanities; Australia - lower secondary education; educational trends; ability grouping; educational relevance.

00299 - **Making science, technology and mathematics education relevant: overview paper.** Lucas, A.M. London, Commonwealth Secretariat, 1986. p. 4-14. (Making science, technology and mathematics education relevant) (eng). // Commonwealth Secretariat // Commonwealth Association of Science, Technology annd Mathematics Educators. Asia Regional Biennial Workshop, 6th, Singapore, 1986

Brings together the lead papers of the conference, challenges assumptions in them, and raises questions for discussion.

Keywords: general education; technical and vocational education; teacher education; nonformal education; mathematics education; educational relevance.

00300 - **The Nature of science processes and its implications for science education.** Yap Kueh Chin. Penang, Malaysia, SEAMEO-RECSAM, 1986. p. 24-32. (Journal of science and mathematics education in Southeast Asia; IX, 1) (eng). // SEAMEO. Regional Centre for Education in Science and Mathematics

Discusses three issues: (a) Are science processes by nature inductive or deductive? (b) In accordance with the nature of science processes, should an inductive or deductive approach to instruction be emphasized? (c) Should science processes be taught separately or within the context of a science subject? Considers implications for science education and teacher education. There is an extensive list of references.

Keywords: science philosophy; curriculum development; teaching methods; teacher education - deduction; reasoning.

00301 - **Physical science, society and technology: a case study in the sociology of knowledge.** Fensham, Peter J. Melbourne, Australia, ACER, 1988. p. 375-386. (Australian journal of education; XXXI, 3) (eng). // Australian Council for Educational Research

Interest in making science and technology more relevant and more accessible to all school students is evident in many reports. This case study explores the aspects of epistemology and curriculum organisationthat evoke special forces which control content. Some difficulties facing such a direction in science education are identified. There is a description of the effects of pressure groups threatening the spread of courses which incorporate the sociology of education and of science.

Keywords: educational relevance; secondary school curriculum; general education;

epistemology - technology; pressure groups; sociology of science; sociology of knowledge.

00302 - **The Place of science and technology in school curricula: a global survey.** Paris, Unesco, 1986. 77 p. (eng). // Unesco

This document arises from responses from 97 Member States to a 1984 questionnaire. It reports practice in those countries classified into five regions. Within each region, findings are given on school systems, science in classes designated 'primary' and 'secondary', practical work in science, mathematics, time allocated for mathematics and science, technology and other subjects. There is also a short subject on issues arising on each of these concerns. Primary science shows wide variation in practice and difficulty in implementation; and it is commonly taught in the context of a broader approach. At the lower secondary level science is commonly taught as an integrated course. At upper levels there may be wide variation in policy.

Keywords: primary education; secondary education; general technical education; comparative education - Africa; Arab countries; Asia; Oceania; Europe; Latin America; Caribbean; questionnaires.

00303 - **Recent developments in primary and lower secondary school science.** Harlen, Wynne. Paris, Unesco, 1986. p. 29-47. (Innovations in science and technology education) (eng). // Unesco

Considers the science that is appropriate at primary and lower secondary levels and the integration within science and with other subjects. Discusses content selection and organization, continuity from primary to secondary level, teacher training and the provision of resources. Is optimistic about progress in tackling problems of science in primary schools.

Keywords: primary school curriculum; secondary school curriculum; lower secondary education - learning processes; teacher education; teaching materials; teacher attitudes.

00304 - **Relevant education for agriculture and production (REAP).** Eck, D. St. Augustine, Trinidad and Tobago, University of the West Indies, 1986. p. 115-120. (Science education research in Latin America and the Caribbean) (eng). // University of the West Indies (Trinidad and Tobago) // Conference on Science Education and Research in Latin America and the Caribbean, Port-of-Spain, 1986

REAP is a project in Belize which relates the curriculum to the child's environment and uses a practical approach. The integrated curriculum has the following aspects: village/urban study, land and water, ecology, weather, agricultural practices, health and nutrition, and animals and plants. The project is considered highly successful.

Keywords: educational relevance; environmental education; rural environment; agricultural education; health education; nutrition education; Belize.

// Rural Education and Agriculture Project (Belize)

00305 - **Science and technology education towards informed citizenship: the ethics and responsibility related to environment, food and health, industry and information technology and energy.** Tendencia, Cynthia P. Penang, Malaysia, RECSAM, 1986. 145 p. (eng). // SEAMEO. Regional Centre for Education in Science and Mathematics // International Council of Associations for Science Education. Asian Symposium, 5th, Penang, Malaysia, 1986

The objectives for the symposium were as follows: (a) To determine what the average citizen should know on environment, food and health, industry and information technology, land, water and mineral resources and energy as to enable him to make rational decisions. (b) To change and to disseminate teaching/learning materials available from various countries with the intention of promoting the development of science curricula for informed citizenship. (c) To expose science educators to various teaching strategies and approaches for such a curriculum. (d) To foster international exchange of ideas among educators concerned with the need for development of a science curriculum oriented towards informed citizenship. The report includes the texts of papers provided for the meeting and reports of the discussions.

Keywords: science popularization; nonformal education; adult education; Asia - health education; environmental education; nutrition education; teaching strategies; teaching materials; curriculum development; educational cooperation; scientific literacy.

00306 - **Science education for all: an analysis of the issue in the Hong Kong context.** Kee Tao Ping. Hong Kong, Chinese University, 1986. p. 72-78. (Chinese University education journal; 14, 1) (eng). // Chinese University (Hong Kong)

States that the common school curriculum in Hong Kong caters to the academically gifted. Advocates a broad and balanced science curriculum, differentiated to a range of abilities and aptitudes, to be followed by all students throughout the five years of secondary school. Presents four purposes for science education and describes curriculum revisions needed to achieve these purposes.

Keywords: secondary school curriculum; curriculum evaluation; Hong Kong - academic achievement; gifted students; ability grouping; aptitude; curriculum development; educational aims.

00307 - **Science, technology and society courses: problems of implementation in school systems.** Paris, Unesco, 1986. p. 143-154. (Innovations in science and technology education; 1) (eng). // Unesco

In various contents there is a diversity of objectives of such courses and no long-established academic community in higher education and new demands on teachers. There is a review of attempts to incorporate science, technology and society considerations into the curriculum, but few of these for younger children. Needs are identified and strategies suggested.

Keywords: science and technology; social values; curriculum development; teacher role.

00308 - **Science, technology and society: educational implications.** Baez, Albert V. Paris, Unesco, 1986. p. 137-142. (Innovations in science and technology education; 1) (eng). // Unesco

The author takes the environment as an excellent integrating theme which can give relevance and a societal focus to science, technology and society activities. He advocates a strategy to teach science and technology in socially responsible ways in which behavioral changes are considered just as important as scientific information and technological skills. The ultimate aim is to infuse the environmental ethic into all science and technology education, formal and non-formal.

Keywords: environmental education; environmental conservation; educational relevance - environmental perception.

// "World Conservation Strategy"

00309 - **Stimulating innovations at the international level: Unesco's role in science and technology education.** Paris, Unesco, 1986. p. 163-188. (Innovations in science and technology education; 1) (eng). // Unesco

The chapter shows how, since the beginning of the present decade, Unesco's emphasis has been the application of science and technology education to the needs of daily life and development of society. Its role has been to catalyse efforts at various organizational levels and to assist in the initial orientation, facilitating contact and exchanges and providing technical back-up.

Keywords: educational innovations; educational cooperation; educational relevance; general education; educational projects - general technical education; pilot projects; rural education; environmental education; out of school education; extracurricular activities; health education; Africa; Australia; China; India; Philippines; Sri Lanka; Barbados; Brazil; Colombia; Peru; Spain.

// Unesco-Aims and activities

00310 - **'Street science' and the CXC integrated science basic proficiency syllabus.** George, June M. St. Augustine, Trinidad and Tobago, ASETT, 1986. p. 1-4. (Journal of education in science for Trinidad and Tobago; XIII, 2) (eng). // Association for Science Education of Trinidad and Tobago

This article arises from a study into local beliefs for which conventional science has different explanations, of concern to science educators. A Caribbean Examinations Council syllabus has a science-for-the-living focus, and the writer classifies a number of street science items against related CXC syllabus objectives.

Keywords: education and culture; cultural values; teaching strategies; upper secondary education; Caribbean; Trinidad and Tobago.

// Caribbean Examinations Council Integrated Science Basic Proficiency

00311 - **Teaching natural sciences: an integrated approach.** Hecht, Karl. London, IOP, 1986. p. 283-287. (Physics education; XXI, 5) (eng). // Institute of Physics (UK)

The author, a German professor, advocates an integrated course which encompasses central topics. He believes that the aims of science education - especially that of providing useful reference points for later life - will be achieved more effectively by an integrated approach.

Keywords: educational aims; concepts; physical sciences.

00312 - **The Teaching of science and technology in an interdisciplinary context: approaches for the primary school.** McLeod, Sinclair; Mills, George. Paris, Unesco, 1986. 133 p. (Science and technology education document series; 19) (eng). // Unesco

The authors direct the Primary Science Development Project of Scotland. Their thesis is that the teaching of concepts, processes and skills of science may be more effective if linked with other subject areas. In particular, links of science and technology in everyday life may become more "real" to children if presented through interdisciplinary teaching. A number of examples of relevant approaches provide extensive illustrations.

Keywords: primary school curriculum; interdisciplinary approach; teaching methods; UK - teaching strategies; activity learning.

// Scottish Primary Science Development Project (UK)

1987

00313 - **Curriculum development and the concept of "integration" in science: some implications for general education.** Adeniyi, E. Ola. New York, John Wiley, 1987. p. 523-533. (Science education; LXXI, 4) (eng).

Gives the background to the major science education programmes in Nigeria which stress integration. Favours integrated science for primary and lower secondary education, but suggests that there may be problems. Advocates vigorous research and teacher training to improve practice, now that most schools in Nigeria offer the subject.

Keywords: curriculum development; primary school curriculum; lower secondary education - educational research; teacher education; Nigeria.

00314 - **Education and health.** Kelly, Peter J.; Lewis, John L. Oxford, UK, Pergamon Press, 1987. 296 p. (Science and technology and future human needs; 5) (eng). // International Council of Scientific Unions // Conference on Science and Technology Education and Future Human Needs, Bangalore, India, 1985

In the context of education in schools and elsewhere, the book deals with the concept of health, teaching/learning, the quality of life, environment, traditional styles of medicine and modern technologies. There are many short papers from a wide range of contributors.

Keywords: health education; primary education; secondary education; out of school education; teaching methods; learning methods; quality of life; environmental education; traditional medicine; new technologies; ethics of science.

ISBN: 0-08-033947-6.

00315 - **Education, industry and technology.** Waddington, David J. Oxford, UK, Pergamon Press, 1987. 365 p. (Science and technology education and future human needs; 3) (eng). // International Council of Scientific Unions // Conference on Science and Technology Education and Future Human Needs, Bangalore, India, 1985

The sections are as follows: A. Industry, technology and the primary school; B, C, D, E, F. Industry and technological issues in secondary science curricula; G. Education and the world of work; H. The role of tertiary institutions in development; I. Technical training for development; J. Making curricula relevant for industry and the role of teacher training; K. Co-operative education. There are numerous contributions from a variety of sources.

Keywords: science and technology; industry and education - secondary school curriculum; primary school curriculum; higher education; teacher education; education and development; vocational training; technical and vocational education; teaching strategies; teaching materials; educational relevance; examinations; work experience programmes.

ISBN: 0-08-033914-X.

00316 - **Energy resources in science education.** Kirwan, D. F. Oxford, UK, Pergamon Press, 1987. 214 p. (Science and technology and future human needs; 7) (eng). // International Council of Scientific Unions // Conference on Science and Technology Education and Future Human Needs, Bangalore, India, 1985

This book aims to examine the energy perspective in education on all levels and ideas for teaching about the sources and use of energy, the energy problem and conservation and environmental issues. The six sections of the book each contain chapters written by a variety of contributors.

Keywords: energy education; primary education; secondary education - energy conservation; environmental education; higher education.

ISBN: 0-08-033951-4.

00317 - **The Environment and science and technology education.** Baez, Albert V.; Knamiller, Gary W.; Smyth, J.C. Oxford, UK, Pergamon Press, 1987. 430 p. (Science and technology education and future human needs; 8) (eng). // International Council of Scientific Unions // Conference on Science and Technology Education and Future Human Needs, Bangalore, India, 1985

The five parts embrace all levels of formal education as well as public education and the community. Within each part there are contributions from a number of authors; and nearly all parts are rich in case studies.

Keywords: environmental education - primary education; secondary education; higher education; technical and vocational education; nonformal education; school community relationship.

ISBN: 0-08-033953-0.

00318 - **Ethics and scientific activity: implications for science education.** Matete, K. Roma, Lesotho, LSMTA, 1987. p. 6-7. (Lesotho Science and Mathematics Teachers Association newsletter; XX, 1) (eng). // Lesotho Science and Mathematics Teachers Association

Considers the traditional image of ethical neutrality in science and a darker side which has come with scientific advancement. Argues that school teachers must stop teaching science with indifference, because science is a public activity with important social consequences. Suggests steps towards changing the attitudes and updating the skills of teachers. Advocates encouraging teachers to provide open-ended fora in classrooms, leading to reasoned personal decisions by individuals. Liaison with social studies teachers is also recommended.

Keywords: ethics of science; teaching strategies; teacher attitudes - discussion (teaching method); social responsibility; social studies; interdisciplinary approach; Lesotho.

00319 - **Food, agriculture and education.** Rao, A.N. Oxford, UK, Pergamon Press, 1987. 247 p. (Science and technology education and future human needs; 6) (eng). // International Council of Scientific Unions // Conference on Science and Technology Education and Future Human Needs, Bangalore, India, 1985

This volume identifies and discusses five areas related to food and agriculture: food production, food consumption, preservation and storage, biotechnology and technology tranfer. Section A is a general section with a number of authors writing about agriculture, food and nutrition in education. Section B consists of illustrative case studies. Section C is an account of the discussions that took place at the conference. There is a final section consisting of four papers related to the subject.

Keywords: agricultural education; nutrition education; primary education; secondary education; biotechnology; technology transfer; curriculum development.

ISBN: 0-08-033949-2.

00320 - **Integrated science: a viable alternative.** Skinner, R.R. Hatfield, UK, ASE, 1987. p. 561-565. (School science review; 224) (eng). // Association for Science Education (UK)

A study investigating whether students who had studied SCISP to O-level were disadvantaged in A-level science. The conclusion is that A-level physics and/or biology candidates were not penalised; only the chemistry candidates who had followed SCISP did less well than those who had done an O-level chemistry/biology combination.

Keywords: specialization; upper secondary education; examinations; academic achievement; UK - chemistry education; biology education; physics education.

// Schools Council Integrated Science Project (UK) // General Certificate of Education (UK)

00321 - **Land, water and mineral resources in science education.** Graves, Norman J. Oxford, UK, Pergamon Press, 1987. 312 p. (Science and technology and future human needs; 4) (eng). // International Council of Scientific Unions // Conference on Science and Technology Education and Future Human Needs, Bangalore, India, 1985

This book deals with the value of teaching about the earth's resources, the content areas which might be included, and the teaching strategies which might be appropriate. The three main parts represent land use, water resources and mineral resources. There is a wide variety of contributions.

Keywords: natural resources; earth sciences; teaching strategies; curriculum development - water resources; mineral resources; land resources.

ISBN: 0-08-033945-x.

00322 - **Learning and applying integrated science through extra-curricular activities in the junior secondary level.** Perera, L.P.M. London, Junior Club Publications, 1987. p. 34-39. (Commonwealth Association of Science, Technology and Mathematics Educators journal; VII, 3) (eng). // Commonwealth Association of Science, Technology and Mathematics Educators

This enterprise, winner of joint second prize in the 1986 CASTME Awards, is an out-of-school venture in Sri Lanka for 11-16 year olds. The central aim was to teach some concepts in integrated science, and this was approached through stimulating curiosity, creativity skills and attitudes, and the use of scientific method in problem solving. The article includes a detailed illustration of one of the five projects "What's happening outside?". The investigations appear to have been undertaken individually.

Keywords: out of school education; extracurricular activities; interest (learning); secondary education; skill development; student attitudes; Sri Lanka - activity learning; problem solving.

// Commonwealth Association of Science, Technology and Mathematics Educators awards

00323 - **Physics and technology: a modular solution.** Brown, Colin. Bristol, UK, IoP, 1987. p. 245-249. (Physics education; XXII, 4) (eng).

The article describes a working relationship between physics and technology. In the author's school science and technology are unified and all 4th and 5th year pupils spend 25% of their time on it. The advantages of such a curriculum are identified and a list of the 68 units of work is given.

Keywords: science and technology; physics education; learning modules; modular instruction; upper secondary education; UK.

00324 - **Preservice teachers' acquisition and retention of integrated science process skills: a comparison of teacher-directed and self-instructional strategies.** Strawitz, Barbara M.; Malone, Mark R. New York, John Wiley, 1987. p. 53-60. (Journal of research in science teaching; XXIV, 1) (eng). // National Association for Research in Science Teaching (USA)

Results of the study indicate that the self-instructional method was significantly more effective than the teacher-directed method, but both treatments lead to retention.

Keywords: preservice teacher education; teacher education; teaching methods; USA - self instruction; learning methods; retention.

00325 - **Report**. Lee Kwan Ping, Carol. International Council of Associations for Science Education. Asian Symposium, 5th, Penang, Malaysia, 1986. Hong Kong, HKASME, 1987. p. 86-89. (Journal of the Hong Kong Association for Science and Mathematics Education; XV, 1) (eng). // Hong Kong Association for Science and Mathematics Education

The conference focused on "science and technology education towards informed citizenship". Such education could help citizens make responsible and informed decisions on science related issues, particularly those involving ethics and responsibility. If students are to be trained in decision-making, the type of knowledge generated should be tailored to the particular issues that face the students. "Science and technology" *includes the knowledge of science itself and also the knowledge that is needed to solve problems. A criticism of existing science courses is included.*

Keywords: science and technology; educational relevance; civic education; social responsibility; Asia.

00326 - **Rural science as part of the science curriculum?** Heaney, J.C. Hatfield, UK, ASE, 1987. p. 123-125. (School science review; 246) (eng). // Association for Science Education (UK)

Rural or agricultural science is an example of a technology which children can understand and engage in realistically. The writer maintains that it involves technological matters, social and moral issues, and content in biological science, other sciences, and non-science subjects. He welcomes the possibility that, through the Secondary Science Curriculum Review, many or all science teachers will be able to play an important role in this field.

Keywords: agricultural education; science and technology; educational relevance; social responsibility; interdisciplinary approach; UK - educational trends.

00327 - **School science in West Africa: an assessment of the pedagogic impact of Third World investment.** Urevbu, Andrew O. London, Taylor and Francis, 1987. p. 3-12. (International journal of science education; IX, 1) (eng; abstr. in fre, ger).

The article begins by discussing views of science and criticises the view presented by school science courses. There is a consideration of the content of school science courses. For the junior secondary stage there is as illustration a Nigerian approach which spirals from the immediate personal problems of African children to wider social issues of science. At the senior secondary level, current approaches and textbooks are seen as archaic. The article closes by noting that the African environment and culture hold a rich source of materials for learning about science.

Keywords: science philosophy; sociology of science; educational relevance; West Africa - secondary school curriculum; African cultures; lower secondary education; upper secondary education; teaching strategies; textbooks; Nigeria.

// Science Education Programme for Africa

00328 - **Science and technology education and future human needs.** Lewis, John L.; Kelly, Peter J. Oxford, UK, Pergamon Press, 1987. 185 p. (Science and technology education and future human needs; 1) (eng). // International Council of Scientific Unions // Conference on Science and Technology Education and Future Human Needs, Bangalore, India, 1985

This is the introductory volume to a series of nine associated with the Bangalore Conference. The first part is a historical account of the background to the conference. The second part deals with some of the major issues. The third part lists the contents of the nine volumes of the series; while the fourth part looks toward the future. Appendices provide conference details.

Keywords: education and development; social needs; human resources development; educational planning; educational relevance.

ISBN: 0-08-033910-7.

00329 - **Science education and information transfer.** Taylor, Charles. Oxford, UK, Pergamon Press, 1987. 230 p. (Science and education and future human needs; 9) (eng). // International Council of Scientific Unions // Conference on Science and Technology Education and Future Human Needs, Bangalore, India, 1985

This book is concerned with communication. The 10 chapters, by different authors, cover a wide variety of approaches to communicating with learners. In an appendix there are case studies from various regions (many of them dealing with computers).

Keywords: communication process; computer assisted instruction; information transfer; educational technology; teaching strategies - teaching materials; educational games; audiovisual aids; readability; teacher centres; communication networks.

ISBN: 0-08-033955-7.

00330 - **Social issues: the potential contribution of primary science and technology.** Skamp, Keith. Carton, Australian College of Education, 1987. p. 79-82. (Unicorn; 13, 2) (eng). // Australian College of Education

While the secondary curriculum is often considered an appropriate focus for future-directed studies, elementary science and technology education can contribute significantly to the socialization process. Science education can also help shape youngsters' attitudes and capacity to understand and influence scientific and technogical impacts on themselves and their environment.

Keywords: socialization; primary school curriculum; Australia - student attitudes; technology.

00331 - **Teacher-college students' opinions in Israel and on the West Bank of "what science education is supposed to be"** Jungwirth, Ehud; Zakhalka, Makhmoud. London, Taylor and Francis, 1987. p. 247-257. (International journal of science education; IX, 2) (eng; abstr. in fre, ger). // Hebrew University (Israel)

The author aimed to investigate the effects of a 3 year teacher training programme on views of "what science is supposed to be". That is what socially acceptable responses the subjects think will satisfy "the establishment". Interpretation of the results suggests differences and similarities in school science education and in college education in Jews and Arabs in Israel and Arabs on the West Bank (a three-way comparison). Ethno-cultural variables are expected to apply.

Keywords: teacher education; teacher attitudes; comparative education; Israel; Arabs - higher education; student teachers; student attitudes; survey analysis; educational goals; secondary education.

1988

00332 - **Applications-based science education: should we apply?** Butlin, Chris. Bristol, UK, IoP, 1988. p. 17-23. (Physics education; XXIII, 1) (eng). // Institute of Physics (UK)

The author advocates an application basis for a combined science and technology education. He describes his efforts to develop such an approach, illustrating mostly from physics and (Technical, Vocational and Educational Initiative).

Keywords: science and technology; technical and vocational education; physics education; UK - upper secondary education; examinations.

// Technical, Vocational and Educational Initiative (UK)

00333 - **Assessment of students' learning in science and technology in national and international studies**. Rosier, Malcolm J. Paris, Unesco, 1988. p. 275-282. (Innovations in science and technology education; 2) (eng). // Unesco

Outlines the procedures and concepts in the "Second International science study". Causal models of achievement are given for comparisons among students and among education systems.

Keywords: learning processes; student evaluation; academic achievement; educational measurement; comparative education.

// International Association for the Evaluation of Educational Achievement // "Second international science study"

00334 - **Assessment of students' learning in science education**. Giddings, Geoff; Fraser, Barry J. Paris, Unesco, 1988. p. 257-273. (Innovations in science and technology education; 2) (eng). // Unesco

Deals with assessments often neglected. There are frameworks for the assessment of practical work and attention is drawn to continuous assessment approaches. For the assessment of attitudes to science, particular attention is paid to (Test of Science-related Attitude). Work on the assessment of classroom environment is cited and a typical instrument (ICEQ) is appended.

Keywords: learning processes; student evaluation; school laboratories; practicums; activity learning - student attitudes; classroom environment; evaluation methods; formative evaluation.

// Test of Science-related Attitudes (Australia) // Individualized Classroom Environment Questionnaire (Australia)

00335 - **Balanced science: changes in science education.** Boyle, Alan. Reading, UK, Coles, 1988. p. 9-12. (Careers journal; VIII, 3) (eng). // Institute of Careers Officers (UK)

Distinguishes between balanced science and separate science. Would be useful to disseminate to entrants to a balanced science course, but critical educators will find it partisan.

Keywords: educational trends; specialization; concepts; UK.
// "Balanced Science" (UK) // "Separate Science" (UK)

00336 - **Balanced science equals better science.** Chadwick, Roy. Bristol, UK, IoP, 1988. p. 6. (Physics education; XXIII, 1) (eng). // Institute of Physics (UK)

Presents an analysis of the science background (in terms of number of sciences studied) of students who have qualified to enter a Sixth Form College. Observes that 26% have had a balanced science curriculum (3 sciences) but probably an unbalanced total curriculum. The rest have had an unbalanced or no science curriculum. Presents arguments for Double Award Balanced Science accounting for 20% of curriculum time.

Keywords: upper secondary education; general education; core curriculum; UK.
// Double Award Balanced Science, GCSE (UK) // "Balanced Science" (UK)

00337 - **Balanced science equals better science, pt. II.** Chadwick, Roy. Bristol, UK, IoP, 1988. p. 67-68. (Physics education ; XXXII, 2) (eng). // Institute of Physics (UK)

The author presents an analysis of the science background (in terms of sciences studied) of fifth year students in representative 11-16 schools. He concludes that Britain may have the best balanced science education for a very few but the worst balanced education for the vast majority. Some trends for the better are mentioned.

Keywords: upper secondary education; general education; core curriculum; UK - educational policy; educational trends; educational improvement.
// General Certificate of Secondary Education (UK)

00338 - **A Case for a process approach: the Warwick experience.** Screen, Peter. Bristol, UK, IoP, 1988. p. 146-149. (Physics education; XXIII, 3) (eng). // Institute of Physics (UK)

This approach to science education arises from the belief that it is not the facts themselves but how they are arrived at which constitute an education in science. The six independent processes which form the base are explained. The article ends with a justification.

Keywords: problem solving; activity learning; gifted students - ability grouping; UK.
// Warwick Process Science Project (UK)

00339 - **An Evaluation of the nature and function of the CXC Integrated Science (Single Award) syllabuses.** George, June M. St. Augustine, University of the West Indies, 1988. 94 p. (eng). // University of the West Indies (Trinidad and Tobago)

The objectives of the study were to determine how well the Caribbean Examinations Council (Single Award) syllabuses (a) provide a functional knowledge of science for young Caribbean adults in a technological world (b) may be considered to support other CXC subjects whose content and orientation require a core of scientific knowledge or elements of science (c) serve in preparing candidates for the world of work, particularly in jobs requiring a basic science background. Analysis of the CXC materials revealed strengths and weaknesses. The impact of the subject on science and non-science students is so far slight. The author found that the subject is too new to gather meaningful data about its value in the world of work.

Keywords: curriculum evaluation; educational relevance; education and employment; Caribbean.
// Caribbean Examinations Council

00340 - **Girls and women in science and technology education.** Granstam, Ingrid. Paris, Unesco, 1988. p. 47-58. (Innovations in science and technology education; 2) (eng). // Unesco

Strategies for getting more girls interested in technology include practical technology for small girls, special themes and role plays, spare-time activities and theme *courses, involvement of engineering students in teaching in schools, talks from female technologists and the creation of activity centres.*

Keywords: girls education; womens education; teaching strategies - attitude change; science and technology; teacher role; student attitudes; activity learning; industry and education.

00341 - **The influences of sequenced instructional strategy and locus of control on preservice elementary teachers' understanding of the nature of science.** Scharmann, Lawrence C. New York, John Wiley, 1988. p. 589-604. (Journal of research in science teaching; XXV, 7) (eng). // National Association for Research in Science Teaching (USA)

Major conclusions were that (1) logical thinking ability was the most influential predictor of understanding the nature of science and (2) separate experiences rather than those integrating content and teaching method were superior in developing an understanding of the nature of science. Implications for preservice elementary teacher preparations are discussed. There should be an attempt to promote a complementary view of science as content and as process.

Keywords: learning methods; thinking; reasoning; primary teacher education; preservice teacher education; USA.

00342 - **Innovations in science and technology education, v.2.** Layton, David. Paris, Unesco, 1988. 299 p. (Innovations in technology education; II) (eng; also in spa). // Unesco

The general theme is science and technology education at a time of rapid scientific and technological change. Current trends and issues are reviewed. The main thematic sections are, in the context of science and technology: an appropriate introduction; interdisciplinary approach; education and active life; materials and methods for education. The target readership includes science educators, ministry of education officials and practising teachers.

Keywords: teaching method innovations - girls education; curriculum development; interdisciplinary approach; teacher education; science and technology; education and productive work; teaching materials; computer assisted instruction; evaluation of education.

ISBN: 92-3-102530-9(eng); 92-3-302530-6(spa).

00343 - **Instructional objectives: what effects do they have on students' attitudes towards integrated science?** Olarewaju, Adedayo O. New York, John Wiley, 1988. p. 283-291. (Journal of research in science teaching; XXV, 4) (eng). // National Association for Research in Science Teaching (USA)

Reports a study using two experimental groups (objectives given and not given) and a control group. It was found that (a) the experimental groups had more favourable attitudes towards integrated science than the control group and (b) the no objectives group had better attitudes than the objectives group. There was no significant effect due to type of school or sex of the students.

Keywords: educational aims; curriculum evaluation; teaching strategies; classroom techniques; student attitudes; Nigeria.

// Nigerian Integrated Science Project

00344 - **Integrality and diversity in science and technology education.** Layton, David. Paris, Unesco, 1988. p. 11-24. (Innovations in science and technology education; 2) (eng). // Unesco

As well as movements toward integration of science subjects and of science and technology studies, the author identifies an attempt to make such studies more integral with everyday experiences of the learners and on a continuum from the earliest years to adult life. Alongside this is a tendency towards diversity, which is related to the context of the education and a broadening of perspectives. These ideas are illustrated from the chapters in the volume.

Keywords: educational innovations - diversification of education; educational relevance.

00345 - **Integrated science project: How do the A-level science grades of integrated science pupils compare with those of pupils who take all three separate sciences?** Skinner, R.R.; Fairbrother, R.W. Oxford, UK, Carfax Publishing, 1988. p. 149-154. (British educational research journal; XIV, 2) (eng).

This reports a comparison of A-level results of candidates who had followed an O-level integrated science course (SCISP) against those who had followed the separate sciences. Only in A-level chemistry was there any significant difference, non-SCISP candidates doing slightly better. However, it seemed that other allied A-level subjects in conjuction with chemistry also affected the grades, a combination of A-level biology and A-level chemistry being particularly beneficial. The writers speculate that the combination accounts for the higher chemistry grades rather than any differences in the O-level background.

Keywords: upper secondary education; examinations; academic achievement; UK - chemistry education; biology education; physics education.

// Schools Council Integrated Science Project (UK)

00346 - **Integrating the natural sciences and other school subjects**. Lazarov, Dobri; Golovinski, Evgeny. Paris, Unesco, 1988. p. 113-119. (Innovations in science and technology education; 2) (eng). // Unesco

The structure and curriculum of the Bulgarian system is explained. An 8-year experiment in integration in 30 schools is an attempt to overcome some of the shortcomings of the independent teaching of science subjects. The essential requirement is that science is learnt from diverse sources and is seen as both a product and a powerful determinant of its cultural context.

Keywords: primary school curriculum; secondary school curriculum; textbooks; Bulgaria - teacher qualifications; education and culture; physical sciences.

// Research Group on Education (Bulgaria)

00347 - **Integrating the two cultures at Georgia Tech: a literature and science introductory course.** Armstrong, Paul B. New York, Association of Departments of English, 1988. p. 30-34. (Association of Departments of English bulletin; 88) (eng). // Association of Departments of English (USA)

Describes the success of a Georgia Tech course that integrates science and literature by analyzing the divisions between these "two cultures". Summarizes course organization and content, including section topics; reading material from science, philosophy, and literature; and basic issues confronted in the course.

Keywords: university curriculum; curriculum development; USA - higher education; literature; philosophy; teaching strategies; interdisciplinary approach; reading materials.

// Georgia Tech (USA)

00348 - **Interdisciplinarity in the teaching of science during the first nine to ten years of basic education.** Swartland, Jakes. Paris, Unesco, 1988. p. 91-99. (Innovations in science and technology education; 2) (eng). // Unesco

This is an account of the growth of indigenous integrated science curricula in a number of African countries.

Keywords: interdisciplinary approach; teaching methods; Africa - primary school curriculum; lower secondary education; curriculum development.

00349 - **An Introduction to technology in the early years of schooling.** Mills, George. Paris, Unesco, 1988. p. 31-45. (Innovations in science and technology education; 2) (eng). // Unesco

By the end of compulsory learning a person should be technologically literate and there has recently been seen a need to commence technology education at the earliest stages of schooling. This author sees a fundamental difference between science and technology, but believes when pupils are involved in technology they will be using science. A sequence of process skills is involved in technological problem-solving. Examples are given. Some impediments are identified and recommendations are made for a school policy.

Keywords: primary school curriculum; problem solving; general technical education; activity learning - scientific literacy.

00350 - **Low-cost materials for science and technology education.** Tobon R., Ramiro. Paris, Unesco, 1988. p. 223-239. (Innovations in science and technology education; 2) (eng). // Unesco

Advantages of low-cost equipment go beyond economic considerations and may have pedagogical aspects. National or local production could have several levels, for example the supply of designs, or parts, or kits. Implications of each are discussed and illustrated.

Keywords: teaching materials; cost reduction - appropriate technology; educational equipment; educational experiments.

00351 - **Microworld: the role of the computer in science and technology education.** Marx, George. Paris, Unesco, 1988. p. 241-256. (Innovations in science and technology education; 2) (eng). // Unesco

Educational uses and misuses of computers are illustrated. Microcomputers in schools are seen as having the potential to educate students to anticipate alternative futures, analyse possible risks, make appropiate decisions and "save our planet".

Keywords: computer assisted instruction; microcomputers - microbiology.

00352 - **Modular science and technology at Peers School.** Brown, Colin. Hatfield, UK, ASE, 1988. p. 460-468. (School science review; 248) (eng). // Association for Science Education (UK)

This is an account of what is described as a radical approach to an integrated curriculum (embracing science and craft design technology) and to assessment. The target is children of average ability with an industrial environment. The article provides a rationale, a description of how the system is structured, an outline of the course and some of the experience. The account is not entirely objective, but details could be useful to teachers in other situations.

Keywords: learning modules; modular instruction; secondary school curriculum; teaching materials; student evaluation; UK - vocational education; ability grouping.

00353 - **New methods for training and retraining science and technology teachers.** Power, Colin. Paris, Unesco, 1988. p. 283-295. (Innovations in science and technology education; 2) (eng). // Unesco

New societal demands in science and technology education are outlined, together with new needs in the teaching force, which must be flexible and forward looking. Examples are given of attempts at reform in preservice courses. The continuing education of teachers is also necessary, and the author illustrates from enterprises around the world, including distance teaching.

Keywords: teacher education; teacher effectiveness; teacher recruitment; preservice teacher education - distance education; refresher courses; inservice teacher education.

00354 - **New Nuffield course.** Bristol, UK, IoP, 1988. 70 p. (Physics education; XXIII, 2) (eng). // Institute of Physics (UK)

This announces and outlines the characteristics of a course in which each subject keeps its identity but with inter- and cross-curricular links.

Keywords: upper secondary education; specialization; core curriculum; UK - teaching materials.

// Nuffield Coordinated Sciences Course (UK)

00355 - **Nuffield Coordinated Sciences: aims and history.** Dorling, Geoffrey. Bristol, UK, IoP, 1988. p. 207-211. (Physics education; XXIII, 4) (eng). // Institute of Physics (UK)

This course aims to provide a broad and balanced science course that nevertheless preserves the identities of the separate sciences which were its component parts. The coordination distinguishes it from both integrated science and independent courses in the separate sciences. It matches the National Criteria for "The Sciences: Double Award". The development is described.

Keywords: educational policy; core curriculum; upper secondary education; UK - curriculum guides; curriculum development; examinations; specialization.

// Nuffield Coordinated Sciences Course (UK) // National Criteria for the Sciences: Double Award (UK)

00356 - **The Place of process in physics education.** Wellington, Jerry J. Bristol, UK, IoP, 1988. p. 150-155. (Physics education; XXIII, 3) (eng). // Institute of Physics (UK)

The article focuses more on general science than the title suggests. Citing recent "process-led" science curricula, the author examines critically this increased emphasis. He concludes that the swing from a content-led curriculum has gone too far and suggests a search for equilibrium between "knowledge that", "knowledge how" and "knowledge why".

Keywords: curriculum development; science philosophy; concepts; activity learning.

00357 - **Please mention chemistry.** Jenkins, Edgar. London, RSC, 1988. p. 100. (Education in chemistry; XXV, 3) (eng). // Royal Society of Chemistry (UK)

The author articulates some worries about balanced science for all, and hopes that professional associations will act according to their constitutional duty to foster their particular subjects. He advocates encouraging schools to continue teaching separate sciences where they judge it appropriate. His concerns include teacher preparation for integrated science and a shortage of qualified scientific personnel for industry and science.

Keywords: core curriculum; specialization; chemistry education; secondary school curriculum; UK - social needs; secondary teacher education; education and employment; industry and education.

00358 - **The Potentiality of distance learning.** Tresman, Susan; Thomas, Jeff; Pindar, Katharine. Hatfield, UK, ASE, 1988. p. 687-691. (School science review; 249) (eng). // Association for Science Education (UK)

Innovations in education in the UK include balanced science, which may be taught in secondary schools by specialist-trained teachers. In-service retraining by distance education is one approach to solving the problem, and criteria are identified. The Physics for Science Teachers Project of the Open University is outlined.

Keywords: distance education; inservice teacher education; secondary teacher education; secondary education; UK - specialization; physics education; retraining.

// Open University (UK) // "Balanced Science" (UK) // Physics for Science Teachers Project (UK)

00359 - **Practical work in the teaching of science and technology.** Badran, Adnan M. Paris, Unesco, 1988. p. 211-221. (Innovations in science and technology education; 2) (eng). // Unesco

In addition to promoting understanding of scientific knowledge and methods of working, practical work should now have social relevance and applicability to problem situations in the real world. The examples given cover geysers, generators, turbines and pollution.

Keywords: practicums; activity learning - educational relevance.

00360 - **The Pursuit of the impossible.** Millar, Robin. Bristol, UK, IoP, 1988. p. 156-159. (Physics education; XXIII, 3) (eng). // Institute of Physics (UK)

The author suggests that the process view of science curriculum developers is seriously flawed in both primary and secondary education. He concludes that the challenge is to motivate children to use the cognitive skills they already possess to grasp the scientific concepts in order to make sense of their world.

Keywords: science philosophy; educational psychology; primary school curriculum; secondary school curriculum - concepts; motivation; cognition.

00361 - **(Report).** Unesco International Consultation on Recent Developments in Integrated Science Teaching, Canberra, 1988. Canberra, ICASE, Unesco, 1988. 248 p. (eng). // International Council of Associations for Science Education // Unesco

The consultation aimed to take stock of the current situation and attempted to identify trends and significant changes in integrated science education that had taken place in the ten years since the Nijmegen Conference of 1978. Chapter 2 is a general account of developments in integrated science courses worldwide since 1967. Chapter 3 consists of reviews of situations in countries in seven regions of the world. Chapter 4 summarizes aspects of the Second International Science Study (SISS). Chapter 5 very briefly summarizes discussions of significant issues (content, curriculum and *instructional materials, teaching and assessment, facilities and teacher education). Chapter 6 pinpoints significant issues. The appendices cover a variety of specific topics.*

Keywords: educational trends; evaluation of education; comparative education - student evaluation; school laboratories; teacher education; teaching materials; Arab countries; Asia and the Pacific; Latin America; Caribbean; Africa; North America; Europe.

// International Conference on Integrated Science Education Worldwide, Nijmegen, Netherlands, 1978 // "Second International Science Study"

00362 - **Restructuring the curriculum: some implications of studies on learning for curriculum development.** Driver, Rosalind. Paris, Unesco, 1988. p. 59-84. (Innovations in science and technology education; 2) (eng). // Unesco

The author shows how children's ideas influence the sense they make of learning activities, and identifies the general features of these ideas. Strategies for curriculum planning and teaching are discussed.

Keywords: curriculum development; learning processes; educational psychology - primary school curriculum; secondary school curriculum; student attitudes; teaching methods; reasoning; conceptualization.

00363 - **Science and technology abstracts and information resources (STAIR).** Browning, David. Bristol, UK, J.W. Arrowsmith, 1988. 64 p. (STAIR; 01) (eng).

This is an annotated bibliography of journals addressed to teachers and pupils, with advice on obtaining the articles. Over 150 journals (including specialist ones such as "Tin and its Uses", national newspapers and major American journals) are represented. While most of the items are resources for direct classroom use, there are items of interest to the teacher as a professional as well as abstracts of projects. Various indexes are provided.

Keywords: bibliographies; educational resources; teaching materials; technology; reading materials - upper secondary education; student projects.

ISSN: 0952-9535.

00364 - **Science and technology education and agriculture.** Blum, Abraham. Paris, Unesco, 1988. p. 155-165. (Innovations in science and technology education; 2) (eng). // Unesco

The relationship of agriculture to science and to technology are explored in the context of education. The author is particularly concerned about needs in low-income countries. Examples of attempts at integration of agriculture into science curricula come from Zambia, Australia, Israel, Venezuela and Fiji. There are recommendations for stimulating teachers to take a more active part in science and technology education for rural development.

Keywords: agricultural education; secondary school curriculum - science and technology; educational strategies; rural development; educational projects; developing countries; Zambia; Australia; Israel; Venezuela; Fiji.

// Agriculture as Environmental Science (Israel)

00365 - **Science applied in the Caribbean.** Reay, Judith; Steward, John. London, Macmillan Caribbean, 1988. 362 p. (eng).

The chapters in this book have been written by Caribbean scientists demonstrating their commitment to social issues. For each chapter there are suggested exercises for use in school, and cross references to the Caribbean Examinations Council syllabuses in biology, chemistry, physics, integrated science and social studies.

Keywords: science and development; social needs; educational relevance; Caribbean - teaching methods; biology education; chemistry education; physics education; social studies.

// Caribbean Examinations Council

ISBN: 0-333-46333-1.

00366 - **Science for ages 5 to 16.** London, HMSO, 1988. 142 p. (eng). // UK. Dept of Education and Science and the Welsh Office

The bulk of the publication consists of the report from a working group set up to make recommendations on attainment targets and programmes of study for science in the National Curriculum. The rest is the contents of the Secretaries of State. The working group has *also made recommendations on assessment and other implications on the National Curriculum. The elements for the proposals are attainment targets, programmes of study, time for science and aplication of orders. The attainment targets are grouped together into knowledge and understanding, exploration and investigation, communication and science in action.*

Keywords: educational policy; educational plans; educational reform; educational programmes; educational aims; UK - primary school curriculum; secondary school curriculum; student evaluation.

// UK National Curriculum

00367 - **The Sciences: double award.** Pople, Stephen. Bristol, UK, Institute of Physics Publishing, 1988. 71 p. (Physics education; XXIII, 2) (eng). // Institute of Physics (UK)

GCSE double award science syllabuses vary widely, but not all offer a balanced curriculum and some can cause problems for A-level studies. The Sciences: Double Award is an attempt to identify criteria from biology, chemistry and physics which would make the double award acceptable as an alternative to awards in these subjects.

Keywords: upper secondary education; educational coordination; examinations; UK - biology education; chemistry education; physics education; educational aims.

// The Sciences: Double Award (Joint Council for GCSE, UK)

00368 - **Sourcebook of science education research in the Caribbean.** Fraser-Abder, Pamela. Paris, Unesco, 1988. 198 p. (Science and technology education document series; 26) (eng). // Unesco

The first part of the sourcebook is an annotated listing of papers about science education and related fields in the wide Caribbean area. It includes journal articles, conference papers and theses and covers the period 1970-1987, with a few references to ealier works. The second half of the book provides information of value to research workers interested in on-going activity in the region.

Keywords: educational research; bibliographies; literature reviews; Caribbean - curriculum development.

00369 - **Structuring investigations in the science curriculum.** Foulds, Ken; Gott, Richard. Bristol, UK, IoP, 1988. p. 347-351. (Physics education; XXIII, 6) (eng). // Institute of Physics (UK)

A curriculum based on investigations is seen as relying on a combination of concepts, procedures and processes. The authors classify and illustrate types of investigation and also the factors which cause difficulties with them. There is a brief account of trials of an investigation-based curriculum with lower secondary pupils.

Keywords: activity learning; lower secondary education; curriculum development; curriculum evaluation; UK.

00370 - **The Suffolk experience.** Dobson, Ken; Watts, Graham; Lloyd, Allan. Bristol, UK, IoP, 1988. p. 162-168. (Physics education; 3) (eng). // Institute of Physics (UK)

A project for Forms 3-5 is outlined. It arose from dissatisfaction with current curricula and assessment. The assessment of processes and laboratory skills stimulates teachers towards innovation in approaches. Content is balanced and arranged in three separate sciences. Development has been made by teachers in workshops. Case studies report problems and positive outcomes.

Keywords: upper secondary education; teaching method innovations; curriculum development; educational workshops; UK - activity learning; biology education; chemistry education; physics education; educational coordination; student evaluation.

// Coordinated Science: the Suffolk Development (UK)

00371 - **Technology education in relation to science education.** Carelse, Xavier F. Paris, Unesco, 1988. p. 101-112. (Innovations in science and technology education; 2) (eng). // Unesco

The separation of science and technology education is undesirable, both in terms of the quality of education as a whole and of the opportunities for the development of every child. Arguments for technology education cover the needs for national development, of the school leaver, of women. Desirable characteristics of technology education are summarised.

There are recommendations for implementation and assessment.

Keywords: secondary school curriculum; educational needs; curriculum development - general technical education; teacher qualifications; womens education; evaluation of education; education and development.

00372 - **Training teachers for interdisciplinary work: the state-of-the-art, with special reference to the Caribbean.** Glasgow, Joyce. Paris, Unesco, 1988. p. 121-133. (Innovations in science and technology education; 2) (eng). // Unesco

The chapter covers a spectrum of modification of subject boundaries. Teacher training in each of the fields selected is illustrated by a few case studies. The author's review of the work leads to a set of conclusions to be borne in mind in teacher education for the 'opening up' of science education.

Keywords: interdisciplinary approach; teacher education; Caribbean - agricultural education; nutrition education; environmental education.

00373 - **The Warwick Process Science Project**. Screen, Peter. Hatfield, UK, ASE, 1988. p. 12-16. (School science review; 242) (eng). // Association for Science Education (UK)

The project is developing a "process-led" science curriculum in contrast to a "knowledge-led" one. The article outlines the development procedures, rationale and flavour of the curriculum. Initially it is concerned with ages 11-16, though there is a prospect of continuing the work for primary children. Its effect on children across the ability range is mentioned. Initially, the modules are integrated, but there are plans for later modules on the separate sciences.

Keywords: curriculum development; learning modules; activity learning; UK - secondary school curriculum; primary school curriculum; specialization; ability grouping.

// Warwick Process Science Project (UK)

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